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AVIATION

THE OLDEST AMERICAN AERONAUTICAL MAGAZINE

A MONTHLY PUBLICATION ESTABLISHED 1911

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A MONTHLY MAGAZINE

The Official American Aeronautical Magazine

Published by W. W. WALKER, Editor

Lester F. Brown, Publishing Director

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1931



Let's think and plan in BIGGER FIGURES

At the end of 1930, the 19th year of the aircraft industry, there were less than twenty-six hundred licensed aircraft in this country. It is estimated that only about fifteen hundred of these were privately owned and operated.

When the automobile was twenty-seven years old, there were over eleven and three-quarter millions of motor cars, more than twenty times as many as aircraft.

What can the aircraft industry learn from this rapid universal adoption of the automobile?

Early in its existence, the safety and simplicity of operation of the motor car was brought within the reach of the average person of normal physical capacity. The airplane has required special operators and long, costly training.

Day-in, day-out, security of motor travel was rapidly demonstrated and quickly accepted. The average person has not regarded the airplane, piloted by himself, as comparably dependable.

The Autogiro offers the aircraft industry its first opportunity to analyze the sales development of the motor car. It can be operated, after comparatively brief as-

struction, by any person of normal physical capacity, because the Autogiro is unique in most of the airplane's attributes which are critical for the private owner.

Because of its removal of the airplane's principal limitations, plus its fast-growing public recognition and acceptance, the Autogiro promises the manufacturer a growing market angle to justify their thinking and planning in terms of far larger future production and sales than hitherto.

The Autogiro Company of America is not a manufacturing or selling company. It is solely an engineering and licensing organization. It owns and controls, exclusively, all Autogiro patent rights in the United States. Manufacturing companies of high standing will be licensed to build Autogiros with the full cooperation of our engineering staff. We are prepared to arrange demonstrations to acquaint the industry with Autogiro principles, design and operation, and to discuss production possibilities.

Present licensees are: Bald Aircraft Company, Detroit, Mich.; Kellert Aircraft Corp., Philadelphia, Pa.; Phoenix Aircraft, Inc., Willow Grove, Pa.

Characteristics—The Autogiro differs basically from all other heavier-than-air craft in the matter of its lifting capacity. This lift is given primarily by two rotating blades which take the place of the familiar wing of an airplane. There is no need when this supporting surface of the blades can be stopped while the machine is in the air, as there must be a profound safety by wind pressure caused by the movement of the Autogiro in any direction, climbing, level flight, diving or descending vertically. The supporting surface of the blades is entirely independent of the engine whose sole function is to propel the Autogiro.

The Autogiro presents flying characteristics hitherto impossible. It can take off at low speed after a very short run, and immediately assumes a steep-climbing angle. It can fly well over one mile per hour at a steady 15 to 20 miles per hour. It can be brought momentarily to a standstill and hover. It can bank and turn sharply without loss of lift or forward speed. It can glide or descend vertically at a speed less than that of a man descending in a parachute, and with carefully engineered speed even with a dead engine. Above all, it can save full of men a man from a fall. As a result, little operating skill is required.

At right — Plan of Autogiro capable for the service of the U. S. Air Force.



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Summerill Tubing Is Used Exclusively in All Keystone Army Bombers

672 fighting planes in battle formation is an inspiring sight, and the fact that the spectacular Air Corps maneuvers were not marred by a single accident is a splendid tribute to the efficiency of the Army Air Corps—both personnel and equipment. Summerill is particularly proud of this record, as all the types of planes represented in this vast air armada—excepting one—have SUMMERILL TUBING in their construction. Some of the larger companies for years have used SUMMERILL exclusively in all their planes.

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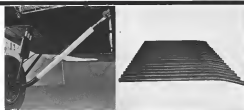
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Army Air Corps

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Exhaustive Testing Done—Airs that landed on 800,000 lbs. per sq. inch

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METLAB



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EDO equipment is a product of years of specialization in float and flying boat hull design and construction. Sturdy built of float materials, perfectly matched to the requirements of any type of plane, especially able in carrying heavy loads off the water, the dependability of EDO

and EDO Floats is proven all throughout the world.

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RUDDERS FOR
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OVER 95 PERCENT

DURING the recent spectacular maneuvers of the U. S. Army Air Corps, more than 95 per cent of the planes taking part were powered with engines equipped with WYMAN-GORDON Crankshafts.

This is an enviable record, and one of which we are justly proud. It is, however, the logical result of 46 years experience in the forging and treating of metal, and of 46 years adherence to one standard of quality.

Whether it be the giant bombers carrying a load of several tons, whether it be the pursuit ships diving at 300 miles per hour, with their crankshafts turning twice their rated speed, or whether it be the familiar transport planes which daily fly the airways there is no substitute for Wyman-Gordon quality!

WYMAN-GORDON

WORCESTER, MASS. and HARVEY, ILL.



can be bracketed with it) are prepared and competent to challenge the world in any sort of mass display or in any test of average flying skill that may be suggested.

True to the pilots is always, and no newspaper has overlooked them. Prone to the equipment is only a little less obvious, but there is a third factor, at least as important as either of the others in its effect on certainty of performance and freedom from accident, that the casual spectators and their newspapers are quite likely to forget—staff work.

Elsewhere in the present issue we have indulged on some of the problems of organization and administration, and told how some of them were solved. Without going into detail here it is enough to recall what every man who is experienced either in military affairs or in the control of large business organizations will realize, that everything depended upon the preliminary planning by the staff in Washington, upon General Pratt's command in Dayton, and upon the commanding officer and his immediate supporters in the field. The record shows that they knew how to reach the men and the material were capable of standing. The spectacular results attained, and the vast scale of the movement, are evidence that they did not sit at their standard for their subordinates too low. The freedom from any untoward event is evidence that it was not set too high.

In judging of the capacities of the personnel, the arm in command knew how far they could go largely because they were dealing with matters within their own experience. Within the past few years, by no one's deliberate plan and certainly by no one's lack in the past, but simply by the natural course of development, there has been steady change in the status of commanding personnel in the Army Air Corps. American students of British military aviation used to envy the Royal Air Force its possession of commanding officers who flew their own planes as a matter of course.

Our own Air Corps was constrained by rapid expansion during the War and the rapid withdrawal of a large proportion of the personnel to commissioned officers immediately thereafter, to depend in considerable part upon high-making officers of great ability and of irrefutable experience, but who were prevented by age, physical condition, or the constant pressure of their administrative duties from becoming fully qualified military pilots. With the passage of time we have outgrown all that. The Air Corps is in the hands of men who have grown up with it since the War or before, and a high order of piloting ability is taken for granted in the wearer of an Air Corps uniform, whether he has a pilot bar or a gold star on his shoulder.

The supreme example of this development held the high command during the Great Aerial Trek of 1933. Benjamen D. Franklin was called to the head of the first air division with more than twenty years of active flying behind him. The record of the air division was in large part his record.

We make it an inflexible rule not to advocate or oppose in these pages the cause of any possible appointment to military command. No civilian outside of the War and Navy Departments has access to the full records of the men concerned in such a case, and none is competent to form a judgment. It is a scandalous thing that the attempt is often made to bring political or personal pressure to bear to control the appointments of military personnel. Nevertheless we insist in advance that we shall be more than pleased if the report, recently emanating from Washington, that General Foshier will be appointed chief of Air Corps upon the expiration of the present incumbent's term of office proves to be a correct one. We believe that there would be general satisfaction at such a decision. It would, we are sure, command enthusiastic approval through all ranks of the Army Air Corps. And all other considerations aside, there would be a popular point of view in the elevation of the Army's first aviator to the first position in the military hierarchy as the crowning event of his military career.

The evolution of military aviation into the hands of the man who fly and who have a simple military bearing. It sets a good example for the aircraft industry. It has been the subject of remark that relatively few of the high executives of airplane companies, accessory manufacturing companies and air transport lines, either are or have been themselves pilots, even in the most modern way. Still fewer keep small private planes and make regular use of them. There are a good number who seldom fly even as passengers except as a means of getting from place to place, and who never think of going aloft with the first pilot to see for themselves what their company's latest product is like. In a very real sense it is difficult for himself how he can best spend his time and how he can best fit himself for the work he is doing, but we suggest that those who fail that their job in the industry has nothing to do with piloting should look carefully into the military example. We venture to predict that five years hence, or ten at the most, a man flying president or sales manager of a company making commercial aircraft will be as strange an anomaly as a manufacturing major in the Air Corps, or an automobile designer who has never driven a car, would be today.

To be or not to be

HAMLET'S question is confronting many air-line traffic managers as they wonder whether or not first-class passengers are to be repeat customers. Disappointing reports occasionally come in about unfavorable impressions given first-timers. Alas, indeed, lack

of comfort, noise, and other factors have been prominently and unreluctantly mentioned by occasional first-time passengers who have climbed out of their first airplane trip with a "Never again." The old theory that one ride would convert any earth-born citizen into a confirmed aerial customer has more exceptions than it should.

Ferretedly, there is a reason for everything, and we may improve the reactions of first-timers by seeking and correcting to advance any possible reasons for adverse prejudice. "The main job is not so much to tell the passenger upon the desirability of taking his first flight as to persuade him, while taking his first flight, of the desirability of coming back for more. Granting that we have done everything possible to impress him with our orderly operation and perfect schedules, there seems little opportunity to do much aerial selling while the plane is in flight, with engines roaring mightily.

There is just one channel of attack—through the medium of the written word. By providing him with appropriately prepared reading matter we may win the day. First we should remind him that if the plane rolls a little, or drops in and out of "air pockets" it is a normal occurrence and nothing to be alarmed about. We should explain just air-sickness is rare, considerably less than seasickness. That if air-sickness does occur once it will not necessarily recur as the passenger gets accustomed to the air. Some hints to supply that sort of soothing information now. Some do it very well. Others, under the same result, do it just as well, or definitely badly. Still others, unfortunately, do not even make an attempt.

After our strenuously prepared pamphlet has treated the more immediate matters which are likely to be apprehensive in the minds of the novice passenger, we can go on to the treatment of some even more vital subjects. A history of the record of the particular airline over which he is flying; an outline of the government requirements for transport pilots and for airplane construction, as a means of the ground organization and of the way in which rules are used; a sound treatment of all these subjects is an attractive little folder which the passenger is inclined to keep as a souvenir will do much to place him in the right frame of mind for another trip. It will be noted that we do not advise flooding the passenger with information about the technical details of airplanes and engines. Upon that point we are in full sympathy with Captain Courtney, who speaks his mind elsewhere in this issue.

It is perfectly possible to post pictures prominently around the walls of most of our present-day airlines. These should be illustrative of the same sort of subject that the pamphlet covers, and also of visible flights made by planes of transport type. Such pictures, with appropriate titles, do much work to give solid confidence and to direct attention from noise or other unpleasant features

A record crosses the Atlantic

THE DIESEL engine took its first step towards acceptance as a power plant for heavier-than-air craft when, in the summer of 1928, a diesel-powered machine first flew. The second step was made at the 1930 Detroit show, when the engine went on commercial sale. The third was accomplished last month, when a plane with a compression-ignition engine using kerosene as a fuel cruised over the beaches around Jacksonville for 84 hours and recorded as performance upon the books as a world's record—the longest flight ever made without intermediate refueling.

With the passing of the refueling-consumption test, and with the apparent decision to allow that record to stand permanently at its present level, trials for straight time in the air without replenishment of supplies begin to require a proper degree of appreciation. No other record, unless it be some of those for speed with substantial dead loads, is of such importance as the one-step distance and duration marks. No other has such bearing upon precisely those qualities of aerodynamic efficiency, fuel economy, and reliability of airplane and power-plant that most affect commercial usefulness. It is more than three years since the duration record left American shores, and it has been more than doubled in that time. Its return is very welcome.

It is doubly welcome for being made with a fundamentally new type of engine. The diesel principle is not a commercial monopoly. It is open to anyone. Already two different designs in America, and one or two in Europe, have been in the air. For ornamental purposes, at least, it seems reasonable to expect that its special advantages will bring it into widespread use. Every practical demonstration of the progress of the diesel toward realizing its theoretical possibilities in the air as it has realized them on land and at sea is a bit of progress toward better and more economical commercial flying, and so benefits the whole industry. The fourth and next most evident is the demonstration will be provided when diesel goes into regular service on some well-known transport line as standard equipment, and the accumulation of data on performance under normal service conditions begins. We believe that that will happen before the end of 1932.

Many men, from Dr. Rudolf Diesel to Walter Lues and Frederic Brassey, have had direct or indirect hands in the making of this record. The greatest of all contributors was that of Lloyd M. Woodson, who created the engine and flew with it in every test and brought it through its early troubles to the point of readiness for the commercial market. The flight that lasted four days and three nights is his memorial, quite as much as it is the bronze plaque unveiled last April in the Detroit show hangar.

What's in Aviation . . .

and why

THE aviation industry has undergone great changes in the last year, and we have modified our own *Aviation* and content to keep pace. Careful analysis, backed by fifteen years of experience in aeronautical publishing, has led us to a reevaluation of innovations. They have been introduced gradually, with no profuse trumpeting. With this issue, which marks the completion of a year since the decision was taken to change from weekly to monthly publication, it seems appropriate to talk the content of the paper over with the readers.

A year ago we were printing 60 pages of news a month. We were carefully following and reporting to talk, even the most minor events of the day. In the midst of weekly news, missing a hundred items of fleeting and local importance or none at all, the occurrence of real and permanent significance was in danger of being overlooked entirely by the reader.

We tried to find out how much all that really meant to the industry, and to the people who are making for themselves rising positions in the aeronautical world. We went to some pains to inquire how many of them really wanted an indiscriminate accounting of every thing that happened, large or small;—and as a result of our examinations we began to present the news in an entirely new form, designed to fit most closely the desires of the great body of our readers.

We proposed today the theory that there are a very limited number of aeronautical happenings that are of lasting significance,—that have a fundamental effect on the present or prospective place of aviation in the community,—happenings about which everyone who has any interest in any phase of aeronautical activity ought to be informed. We undertake to winnow out such events from among the great body of material that reaches us,—to set them in logical order, bringing together those that are related or that react upon each other,—to point out the trends that the news dispatches indicate,—and to supply any historical background or editorial information that will be useful to the reader. We set the results up in such issue, immediately following the editorial pages, as a coherent running story of the news of the month. The man who will devote half an hour each month to reading that department will, unless we are grievously failing in our self-imposed task, emerge from it with a clear idea of where aviation is going and how. By deliberate choice we have substituted this novelty in news services for the perusal and presentation of innumerable disconnected items, for we believe the new form far more diversified, and far more useful, than the old.

Statistics form an integral part of the news, but a highly specialized part, and statistics alone can offer a very complete record of progress. There are some charts, like that of the rate at which student permits

are being issued, that ought to be watched at every glance by everyone in the business. There are others, like that of the number of airports in service, for which revision every few or six months is quite enough. Still others become important at irregular and unpredictable intervals.

To give them all their due, we set aside each month two pages adjacent to the news section. A few stories, those which so sales manager or general executive can expect to be important to our company's future and making its plans, are repeated each month. Aside from that, there is no standardization except a standard purpose to collect the current figures that are of greatest importance to the American aviation, to present them in such fashion, by graph or table, that their vital points can be grasped at a glance, and to supplement them with brief analyses and explanatory comments. The type of information that is contained in those pages, together with more far-reaching compilation such as the annual statistical news sheets together, seems to us essential to the industry and to every intelligent leader of its operations.

In general, we don't believe in trying to suggest knowledge into departments. *AVIATION* is covering the whole field of design, construction, and operation. However, although the various groups within the industry have a common interest in all aerial progress they also have specialized problems belonging only to their own parts of the field. Hence the group of departments that follow after the feature articles each month.

To the service engineer or maintenance superintendent and to the mechanic we specifically address the *Servicing Short Gas*. Through that page we give them the opportunity to exchange ideas, methods, and new designs for tools and fixtures with their fellows in other shops.

Airport operators have their own section, conceived in exactly the same spirit as an experience exchange. Once a year a national airport conference brings the operators together, to discuss not only such questions of legal status and financing but also the little details that have been developed to attract a larger patronage and to handle the visitors after they arrive. Once a month, the Airport Management section of *AVIATION* appears with the same purpose.

The success of the operator of metropolitan aerial service depends very largely on his success in introducing new ideas for using aircraft and persuading the people of his community to adopt them. A new idea developed by some other operator in a distant city is just as good as a wholly original one, and every report of such a novelty is a potential opportunity for new profit. The department entitled *Aircraft at Work* exists for the sole purpose of bringing such reports.

Merchandising and design, too, are something more than the application of general theory. They depend again largely on the solution of particular problems of detail. Hence, the *Salesman's Notebook* and *Design Newsletter*.

News of the Month

The month's
gist of records

After two previous attempts thwarted by weather and a broken oil line, a *Fokker C-4*—powered *Belgian plane*, flown by Walter Lee and Frederick A. Brown, established a new world record, enclosing *London flying record*, on crossing *do record* made by two French pilots, Boncompagni and Rossi, by 9 hr. and 36 min. The plane, whose engine had already flown 15,000 mi., was in the air 34 hr. and 33 min. over Jacksonville, Fla., and the surrounding country. The duration record, three years earlier in Europe, thus returns to the United States.

New airplane records for duration and distance were established in a flight by the French pilots, Lieutenants Puri and Gaudet, over a circuit of 315 mi. near Arras, France. They flew their six and one-half hp. plane for 36 hr., 46 min., and 48 sec., and covered a distance of 3,230 mi. It is not yet known what dead load the plane carried on the flight, but it does not appear that the absolute duration record for airplanes without dead load is effectively broken, as the present record (held in Australia) is 36 hr. 1 min., and the F.A.I. rule requires that permanent records be completed by at least an hour. The existing airplane duration record, also American, is 3,200 mi., and has now been broken by a good margin.

Another record on records now held in France is contemplated by the British Air Ministry. Remonstrations by the *Parry Aviation Company*, of the plane in which two pilots were killed last year when they struck a mountain while flying high, is under way. When completed, this outcrafter, with a 90 ft. wingspan and a fuel capacity of more than 3,000 gal., will try for the long-distance flying record now held by Cook and Bellairs for their non-stop flight of 4,912 mi. from Paris to China. The previous attempt, made by the same pair, was for a non-stop flight from England to Cape Town (about 5,000 mi.) while a mail carrier Berlin of *do* had made a record non-stop trip from England to India.

Capt. Paul H. Hawks has spent the last month studying European ideas of airplane speed by splitting records which have previously stood for the fastest air transportation. From London to Berlin in 2 hr. 57 min. was

latter time than a *deplane* dispatched at his departure could make. The past day he set a 48-minute mark for the flight between Berlin and Stuttgart. A week later Captain Hawks was in way around Europe. Flying in Paris he flew to London for breakfast, thence to Berlin for luncheon and back to Paris in time for dinner, about 7 hr. and 35 min. in the air.

Linking the continents

A new record for the flight from England to Australia and return has just been established by Charles W. A. Scott, who believed Wing Commander Austin Knight-Smith's time in each direction, clipping 46 hr. from the former record for the return trip. The time from Weymouth, West Australia, to Lympne was made in 11 days, on most of which he maintained maximum in strong headwinds. The outward trip was made in 9 days and 3 hours.

In consideration of return time via the trade winds, maximum in return to Genoa, the *DoX* finally took off on June 4, from Pointe à Pitre, Cape Verde Islands, and flew to Bermuda. It made about 200 mi. off the coast of Brazil, to 32 hr. and 26 min., averaging about 300 m.p.h. for the trip. The following day the remaining distance

was covered to Natal, on the Brazilian mainland, where the plane stopped, being enough to be considered for its great record trip down the coast in Rio de Janeiro and Pernambuco.

Prepare for
blue ribbon races

Italy's participation in the Schneider Trophy Contest conditions is an uncertainty. General Balbo, in his recent speech before the Chamber, prepared the Italian public for the possibility of a withdrawal in some places with a good chance of victory are not equipped at a sufficiently early date. In this connection it is mentioned that private plans with a speed of from 220 to 250 mph. will soon be in regular use in the Italian air force.

An annual race around Britain for the King's Cup will this year, for the first time, have a Canadian contestant. The race is open only to amateurs flying privately owned planes. The invitation is to be a *Curtis-Wright* *Beechcraft*, designed and built in Canada.

Air tour plans mature

Early in June and just after *Blanche Ray Collins* had completed the customary preflighting trip, and with the start of the South Atlantic National Air Tour on July 4 less than a month away, it was announced that because of prevailing bad weather in Mexico during July the itinerary had been changed to include only United States and Canadian cities. A number of changes have been made in the program.

The revised route is: Waukegan, Ill.; Birmingham, N. Y.; Watertown, N. Y.; Bradford, Pa.; Pittsburgh, Pa.; Cleveland, Ohio; Indianapolis, W. Va.; Knoxville, Nashville, Memphis; Birmingham; Gulfport, Miss.; New Orleans; Shreveport; Fort Worth; Dallas; San Antonio; Fort Worth; Wichita Falls; Texas; Dallas; Fort Worth; Pecos City; Chama, N. M.; El Paso; Santa Fe; Albuquerque, N. M.; Santa City; Durango, Colo.; Denver; Fort Wayne; Albany; Kalamazoo and Detroit.

Twelve machines had been entered by June 15—three *Boeing*, two *Pitts*, two *Wright* and a *Curtis-Wright* entry. Another national air tour was being

Calendar

June 27	Twenty-ninth Annual Air Force Display
June 28-30	Fourth National Display Meeting, Los Angeles, Calif.
July 1-2-3	Fourth Canada Air Festival, Toronto, Ont.
July 4-5-6	Fourth National Air Tour, New York City
July 6-11	Second Annual Air Tour of Italy, Italy
July 10	King & Day Air Race, England
Aug. 1-15	Fourth Annual, National Air Tour, New York City
Aug. 15-16-17	Twentieth Annual Air Race, Cleveland
Sept. 1-2	Twentieth Annual Air Race, Cleveland
Sept. 15-17	Third Annual Air Race, New York City
Sept. 18-19	Third Annual Air Race, New York City
Sept. 18-19	International Air Race, Los Angeles

rounded into shape during June. The trans-Canada Air Force, sponsored by the Canadian Flying Clubs Association, is its start from Hamilton, Ont. Dominion Day, July 1, is the start of the first test week when Canada goes from coast to coast. It has been regarded for demonstration of aeromedical equipment and for promoting the local interest in aviation in Canada, and it is to be entirely non-commercial. The Royal Canadian Air Force and many commercial and club airlines are likely to be represented by planes in the event. The second day of France for sport planes was held April 25 to May 30. Thirty-nine of the 52 stations covered the coast, which started and ended at Osh. Flying was done on a mile every other day, the intervening days being devoted to demonstration of machines and social activities. A speed clinic on the last day was the only element of competition.

Cap won, convention planned

The D. C. Air Legion, of Washington, has received a trophy as the outstanding private flying club in the country. The trophy, presented through the American Society for the Promotion of Aviation to President J. Blaine Knox, was earned by the past year's record of 186 new members, 52,000 hours flown and four planes purchased out of lease.

Washington is to be the scene of the annual convention of the National Aeronautic Association on July 23 and 24 this year. The executive committee, of which Porter Adams is chairman, met

unanimous in its selection of the Capital as meeting place. In early previous years, 1967, when the rules were changed, it was the convention in St. Joseph, Mo., the convention and National Air Races have been held together.

Red noses for

Canadian air mail

Canadian aviation was shaken to its foundations last May when the government announced that for budgetary reasons elimination of service air mail contracts and revision of other mail became imperative. First interpretations of the announcement were that practically all air mail service would be cancelled, or reduced to practically complete effectiveness. The government later called these reports misconceptions and announced that negotiations with operators of the larger and more important groups are still in progress.

In the light of latest information, it appears that the Canadian government is about to renege its air mail agreements with the United States Postal Office. Department of Transport officials are negotiating with the domestic air mail carriers a year ago and again in March. Canada's reasons may differ and the action may be more drastic, but the general result seems to be similar. Air mail service to the most outlying communities—such as Adak, on the Arctic Circle, other Yukon points, and the Alaskan Islands in the Gulf of St. Lawrence—will be continued in any case. It is probable, too, that the

United States Canada contracts will be fulfilled. Three of the smaller lines have been cancelled already. Because of the long distances involved and the widely scattered communities air mail in Canada has been considered of secondary value and of much greater cost than in the United States. Canadian and American air mail have much in common and the fairness of use are somewhat relieved by the fact that there are three connecting links between the two countries via Canadian Colonial (New York-Montreal) Northwest Airlines (Ottawa-Winnipeg) and Grand Air Transport (Ottawa-Victoria).

The Montreal-Kinross service has naturally resulted in two-Atlantic mail between England and Canada. Two planes met the new Regent of Britain at the rendezvous point on her first voyage and stalled out to reach Montreal 5 days 8 hr 10 min, from Southampton.

American mail services happier

Expense of American air mail has been much discussed in government circles in connection with the President's budget. The government is not the new deficit. It is officially announced that the air mail service (domestic and foreign combined) last year cost the Post Office \$20,618,969 over and above the income received. Mail operators earned \$2,911,151 in passenger and express traffic in addition to mail revenue.

Despite deficits, American air mail services are being expanded. On June 15, American Airways began operating daily service between Washington and Pittsburgh. On June 15, American Airways began operating two extensions, an extension of its Atlanta-Los Angeles run. These are the Nashville-Pittsburgh-Wash. by way of Memphis, Little Rock, Fort Worth and Dallas, and a Chicago-Jackson New York service.

As a result of the latter contract, Robertson Airlines, which has been operating a passenger service between St. Louis and New Orleans by way of Memphis April 27, 1970, suspended operations. A number of its pilots and officials have joined the American Airlines way staff.

While no formal protest has been filed at the time that is written, there were indications in Washington that the several of these extensions in American Airways may arouse some opposition. The Cargill-Rogers General's office is yet to be heard from.

In a similar instance the Comptroller General held that the act of Congress

prohibiting the extension of an air mail route does not allow an entirely new route to be established as an extension of an existing contract. In that case (extension of the Northwest Airways route between Chicago and Minneapolis to Omaha), Comptroller General ruled that a new routing between Omaha and Winnipeg did not constitute an extension and the project was abandoned.

As a test of whether a proposed route may be regarded as the extension of another, the Comptroller General ruled that prime importance to the interchange of mail that may be offered. One of the new routes is that the bulk of mail going north from New Orleans will not be transferred at Jacksonville to planes on the transcontinental route, but will continue on to such centers as Chicago, Cleveland and St. Louis.

Cities combat choice of Charleston

Air mail interests, particularly Pan American and American Airlines, are voicing the Post Office Department's recent contract for bids on the United States-Bahamas routes of the proposed trans-Atlantic air mail service. In the meantime, New York and Baltimore have been conducting the transportation of Charleston, S. C., as the stop-off point. The Post Office Department, however, wishes to consider the matter as finally settled. Charleston is about 825 mi. from Bermuda, Baltimore is about the same distance, and New York City 450 mi. nearer.

Representative Kelly of Pennsylvania, author of the first air mail bill, has promised to introduce to the next session



NEARING COMPLETION AT AKRON

Constructing of the Navy's new aircraft is proceeding rapidly, and the first test flight is scheduled for some time in July.

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of Congress legislation providing for the loss of mail under contract. The purpose is to simplify the tender route by flying planes to mail capacity and moderate speed along the main routes, parking up mail at intermediate points and delivering it to the larger and faster facilities at regular stops.

Airline affairs in Europe and the Orient

The Indian government, as part of its program to handle directly the development of airlines in that country, has ordered that all firms (previously like the F. H. P. and the Indian Airlines) must be the former.

This will concern primarily the airlines of another link in Imperial Airways' long proposed London-Australia air mail service. Progress in reaching that is not extremely slow. The initial air mail service is expected to begin in the latter half of 1971. The flight back from Australia requiring about 10 days.

Recent information from Europe indicates that negotiations and contracting of Compagnie Generale Aérienne (CGA) and Air France to operate the mail service in Africa and South America is being accelerated through cooperation of the French government. The Associated Press reports that a \$500-a-week Shanghai-Berlin air mail service was inaugurated May 31 by German pilots in French planes. That day in the air mail service has been a small success, and that it may not

even affect the nerves of the passengers, was demonstrated recently on an Eastern Air Transport plane en route from Washington to Newark. Deliberate in addition of a heater pipe at the point where it entered the fuselage started a fire in the cabin. With the engine stalled it with an engine after the pilot made a landing in an emergency field. The next plane flying in on regular schedule pulled in at every moment as possible and brought them to Newark, the only persons suffering any inconvenience being those having to find alternate means of transport to New York.

Express by air expanding

An express service recently inaugurated expedite mail shipments in the United States and over an eastern border. Through agreements between the Transcontinental Airline Corporation and the Western Union Telegraph Company services mid-western cities now enjoy fast express service. Collection and delivery of mail by Western Union messages and their transportation by the planes of T.A.C. make it possible to use a package from New York. Certified to destinations Detroit in 35 minutes, and from Detroit to Chicago in two hours and a half.

Equally efficient service is available from the U. S. to seventeen of the South and Central American countries served by the Pan American Airways, through its service to the Caribbean. Express Agency in this country. During down times, demands for a single document, an "airmail" reduces the first necessary for international shipments to mail and even overland that required by the first-class steamer.

New routes, and new rates

The Boeing Company has issued Guided Air Lines—Strong Air Transport, Pacific Air Transport, Midland Air Transport and Varney Airlines will enter their rivalry at operating with Chicago's inland route to Mexico. The new routes will be Los Angeles-Fort Worth, P.A.T. started on May 24. "Daylight Flight" between Seattle and San Diego, P.A.T. started on May 24. Flights in 11 hr. 20 min. Flights leave San Diego at 7:30 a.m. and Seattle at 8 a.m.

A number of passengers have announced their intention. National Air Transport has cut its rates between New York and Kansas City (by way of Chicago) approximately 10 per cent. The fare being \$23 instead of \$90.35, approximately 90.37 per mile. Canadian Colonial Airways has lowered its rate about \$100 per mile. Pacific Air Transport reduced its rate 15 to 20 per cent in May, to a rate of about \$99.99 per mile.

Transcontinental & Western Air has had more recent reductions, especially



OVER EIGHTY-FOUR HOURS

The plane, the engine and the crew, while brought back to this country the mail on continuing maintenance check. While the plane (left) returned after the pilot, and the engine, and the crew, while brought back to this country the mail on continuing maintenance check. While the plane (left) returned after the pilot, and the engine, and the crew, while brought back to this country the mail on continuing maintenance check.

The Air Corps' mass migration

Its significance to the Army and to the industry

DULY and dramatically celebrated in the daily papers, the great war of 1935 has now its center. With some 35,000 hours of flying behind them the planes and personnel return to their stations and to their normal activities. The developments of the last fortnight of May can now be considered from the specialized point of view of aircraft operations, and their real significance to the military service and to the airplane industry appeared.

The general efficiency of operations, and the splendid performance of men and of machines, were best shown in general terms by the total absence of serious mishaps. The sensational press had seized upon the fact that the average safety record of the Army Air Corps would indicate a probable total

of six deaths in the course of the amount of flying that the men were doing. They had floated over that prediction. They had given reason over it. They had argued in their readers the amount of thrill of hours spent to come, and as the manœuvre drew to a close and the promised debacles seemed to materialize, many of the spectators showed a certain hesitating disappointment. The absence of accident was all the more visible in view of the stress to which the personnel were subjected, flying in formation three or four hours each day and often short on sleep and getting their men's shoes, as, and if the chosen official.

The criticism would hardly have been carried out without failures if the manœuvre had been made in response to actual emergency suddenly arising. The conditions of war necessarily differ from those of peace, and they can only be approximately simulated. They comprise the deliberate assumption of hazards that cannot be

The conditions also up the possibilities of detecting the very few from the air during these the other over the new American bridge.



allowed in peace

times. They involve some transportation of planes, which as the manœuvre of a month ago had been worked out and scheduled as almost every detail from one to four weeks.

Before the first show started for the manœuvre point, Account must be taken, too, of the fact that the planes did not carry the full military load.

Why clear for publicity

Most of all, real war is the air. It is the most difficult thing to do in public. In war the press is necessary for all the information that can be secured, and the position of press releases is largely one of necessity. On peaceful occasions the endeavor is to get as much press attention as possible, combined with a reasonable fear of exposure of what is being done. During the late manœuvre the high command had been made of manœuvre reporters and photographers were welcomed everywhere. From the risk against photographing strikes was ignored for such major services as occurred, and the photographers were allowed free range.

Publicity for military exercises is a very essential thing as to a corner point, but not beyond the stage where it takes control of the operating plan. Air Corps manœuvres should be kept military. That they are also a very striking public show is a happy accident, but it should be only an incident. They ought never to be mingled up with a program of public entertainment in any way military, implying upon the Air Corps upon the obligation of putting on a spectacular display. The Army ought to run the same affair and be free to make its plan and change them as well without involving anyone re-

ceive those directly and necessarily involved in the movement of the planes. To be specific, dedications such as that of the New York Manhattan Airport have no proper place in a manœuvre program.

Air parades and tactics

From the most narrowly military point of view, the manœuvre of 300-odd planes would be equally subject to challenge. They meet a popular ideal of great forces going forth to combat in some, but a manœuvre composed of great bodies of pursuit, attack, observation, and bombardment planes, presenting in solution of squadrons, has no more relation to the way in which aerial combat is conducted than has close order infantry drill to actual warfare. Like infantry drill, the manœuvre certainly has great aid. They are a test of discipline and of doctrine, and of ability to adhere to a plan. They are useful in developing

flying technique, but they are without direct tactical significance. Most of the reviews during the manœuvres were carried off with extraordinary success, although in one or two cases the timing was unfortunate and there were long gaps in the line of parade. In the review over Floyd Bennett Field, on the other hand, in spite of a low ceiling, almost of an early storm, and very hazy air, 650 planes went in formation sixteen miles. At least twelve machines passed during each episode, and there were only three of the fourteen episodes in which the number passing fell below 60, only two in which it was above 60.

The manœuvres have made it even more apparent that it was before that on our divisions to purely an administrative unit, and that the group of units as few squadrons, or under very favorable conditions a wing of two or three squadrons that carry, in the broadest sense, should be tactically employed in a unit with all of the planes having any direct contact with each other. When more



The pilots took great pride in making their planes too old stand out clearly and without external assistance, showing the whole number at Dayton. At right: An observation group at Mitchell Field. (Photograph by courtesy of Army Air Corps)



The Air Corps manœuvres have been generously exploited by the newspapers. Speculative have been deservedly limited on the skill of the pilots and on the spectacular quality of these displays. We have written here for those professionally engaged in aeronautics, not for the miscellaneous public, in commenting on the material aspects and how some of the difficulties were overcome. The story of the administration and of the supply organization is less exciting than that of the flying, but it is of even greater fundamental importance.

circumstances that are in the operative, everything depends upon communications and upon the synchronization of watches and getting each unit to a stated place exactly at a stated time when will fit in with the general schedule. Occasions arise where even the group must be dissolved into its component units. For instance, when Major Ryan's observation group made a burst attempt to complete its assignments through northern New England, the weather became impossible. The group was broken down into units to take charge of their respective units and get them to the ground in the best fashion possible.

Radio waves in science

Communication of a highly stable character was vital. Radio communication between planes and between the planes and ground stations was used to a greater extent than ever before in an Air Corps exercise. The system worked extremely satisfactorily, the most serious difficulties arising from the unavoidable interference of powerful commercial stations which in time of national emergency would be subsordinated to military exigencies and would cease to be a hindrance.



Revolving problems were over with them. Top: A small selection of the leafy-truck food assembled at Durrës-Center. Below: A long enough line to service those phones without meeting the Greek. Below: Freezing in snowy Ljubljana.



tactical movements, and for the exchange of weather and special information. Plane-to-ground communication was used for the dissemination of weather information and, in one instance—at Springfield, on the return from Boston—the service was used to speed up the landing of the units in the face of approaching bad weather. In this case, the officers who supervised the landings ordered the units on from their waiting areas in turn in advance of the carefully timed schedule so the large field became clear.

Wing and group and in some cases, squadron commanders carried them out.



Radio personnel and portable monitors told each other the commander wanted to take his men. The monitors were so self-sufficient that they even carried their own clocks, described as a safeguard against subversive activities.



sis. Flight leaders carried growing size. One group comprised with the group commander as a wing and the leader of the division team as a wing commander on the ground. These are not to be changed except when weather or some other factor necessitates. Miscellaneous comment between the pilots was exemplified by a conversation between a pursuit group commander and his subordinate in which he announced the loss of a certain tower over which the pilots were then flying on OMA, and cautioned the pilot to note that the emergency field at that point was in reality located on their wings.

Weather closely checked

Other notable examples of the value of the radio for meeting special conditions arising after the planes were in the air were afforded by almost every movement, chiefly because of the vagaries of the weather.

During the parade down the Blanton River valley on Saturday, May 25, an advance plane posted over New York Harbor watched closely the movements of the weather system and reported its location and the state of the clouds and kept the war zone abreast of the weather in general. The word was prepared to advise the commanders to suit for the best fields at the first sign that the storm would strike the area, it concentrated the battle area, while the main force was on the march. Springfield from the Boston display plane flew east from Springfield toward them and reported the weather. This was important because the ceiling threatened to lower and landing facilities were made in that territory would have been impossible.

The travels of the First Air Division constituted primarily a problem of supply and organization. To use the approved technical term, they were a study in logistics. Their tactical and strategical significance was at most

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very secondary. Aside from the enormous magnitude of the movements involved and the number of railroads that had to be handled, there must, interestingly, have been the extensive re-orientation of military and commercial facilities.

Corpus targets self-assertion

From that point of view the results appeared admirable, but they would have been quite as admirable in most cases if the bombings had been made in an open parking lot somewhere instead of on a fully equipped airport. With a few exceptions, the airport management and personnel never needed to enter upon the scene. Almost no war was made of the commercial hangars, and very little of the shops. When in the New England area there were several instances where a war was considered more economical to utilize civilian roads.

himself, and the work was paid for by Army vouchers, but in general the parents were cared for, and such service work as was needed was done, by the personnel of the squadron.

The one non-military activity upon which the maneuvers absolutely depended, apart from their use of commercial airports as landing fields, was the oil industry. The truck drivers and crew chiefs of the oil companies were, again with rare exceptions, the only civilian personnel that had any share in the operations.

Parting experiences valuable.

The advantages of the forklift led to the belief that a large group of places could be served conveniently and quickly by trucks with fuel by the use of a few tracks that by tracking the plows themselves up to pits. A partial comparison between the stationary airplane and stationary fuel source was made at some cases by equipping the trucks with extra lengths of hose to a total of about 30 ft, permitting the fueling of two or three airplanes in a half without moving the truck. This seemed the best and speediest of all the arrangements tried. The possible use of a few trucks to serve all the tanks of the working tracks about and refueling on what was to be done next, averaged about 8 min. per plane per truck (counting more for the bombers). With eight trucks at work, which was

The work was done in Dayton by the Standard Oil Company of Ohio, in

[illegible]

Tank trucks given N, Y, scores

The first serious difficulty, which could have been lightly over-ruled in New York, arose when the New York City authorities announced that the use of a track with a power pump for transporting gasoline through the city was illegal and that the passage of the vehicles from the company's storage base on Long Island City to the Spang brothers' father and on Long Island would be prevented. Their decision was totally unjustified, as their authority on the condition that the trucks be given special protection, and they traveled to New York, and even the highway for and to Long Island, completely surrounded by a formidable pair of motorcycle police. Each truck had a definite station assigned before the planes arrived, and the possibility of accidental fire



Exp. In Eastern the division even had a previously pointed telephone disconnect, with IRS members that Center: Kenneth Feltner's Son King before division headquarters at Folsom. Before Feltner headquarters at Newark were recommended, and offered more money than money.





Lines to twenty planes. At noon as the machines were parked the trucks were driven down the line, taking the planes in order. The total capacity of the trucks considerably exceeded the largest total requirement for any one day, so it was never necessary to send a truck back to the storage base for reloading and have it come out again on the same day. In one case in the Middle West the cord for fast greasing to extract the total capacity of the trucks in the field, and their contents had to be hastily dried out from the aircraft's own supply.

The only unique hitch in the servicing work around New York occurred when a number of the trucks brought down in the west ground and had to be hauled out and hauled again by tractors. There had been a similar experience in one of the Chicago fields, but in that case the rain was so recent and the ground so soft that the trucks could not move at all, and the planes had to be started up again and towed in the rice of the auxiliary apron for towing.

Mule-walker emergencies

Chicago's rainstorm gave a beautiful example of the nature of the delay and uncertainty that may result from even a slight change in the conditions under

which a carefully-planned exercise is carried out. The planes of the attack group landed, were towed to the designated location, stalled down and covered up early in the afternoon. After about an hour of waiting there came the report that the rain would be unable to reach them, and they were all uncovered, warmed up, taxied across the field, serviced, started up again, and taxied back. With only 30 machines in the group arriving some time after the other planes at that particular field had been taken care of, it was almost five hours after landing before the servicing was completed, and another half hour before the pilots were able to leave the field for the base.

Top: The division involved in the baggage of aircraft accidents assembled before a court. Bottom: When radio watch Chicago landings of planes had to be moved through those made there.

Early on schedule, the machines would have been much of their value as a military practice. In the event of war, something always goes wrong and upsets the pre-arranged plan. So true is that, that it would be well in future wars deliberately to introduce uncertainties, even if they have to be done in the name of the machine. It would be well to write out a succession of all possible contingencies and weather changes and disasters on slips of paper, shuffling them up in a hat and draw one out and from there without premeditation as though that particular contingency had actually arisen. There is no real test of the

flexibility and elasticity of staff organization unless or until the unexpected happens.

Keeping the planes serviceable

Supply and maintenance constituted a major problem, and the organization holding these responsibilities was such were commensurate from all quarters. The resources provided not only a test of the whole supply and maintenance system, but also a basis for comparison between the value of service squadrons and the air depot supplemented by the regular plane crews for mounting the corps in the field.

The air depot and plane crew combination was raised upon chiefly in the state's maneuvers, the only kind service representative and long that regularly based at Mitchell Field. Experience indicated that operations within a few hundred miles of a depot would be managed at a high standard. Operations so far away from a depot that frequent and quick transit between field groups and depot would not be available, would constitute a different problem.

The most distant field base in this case was Boston, approximately 200 air miles from Mitchell. The Corps drew on the Fairfield depot when west of the Cape River, and on Middletown when east of the river.

Supply system highly efficient

Using the depot as the main supply base for everything from food to engine and wings, a few and smooth-voiced system of reception and transportation was essential. The first two supply officers carried the main responsibility in the field, assisted by a supply representative in each group. At each field where units were based were machine operators of the air depot who were thoroughly acquainted with parts and procedure and could order and deliver supplies efficiently.

A machine needing a new magnet, for instance, would be equipped with the group supply authority. Such was the group would not carry such as

articles (though it would have such articles as propellers, gaskets, and spark-plugs), the requisition would be passed on to the division supply agent. If it so happened that a particular branch supply storehouse existed in the area—as when the planes were based at Mitchell and nearby fields—the order would be filled immediately from the post stock. If not, the order would be telephoned to Middletown or Fairfield, and the machine would be shipped by the next plane, reaching the mechanics within four to six hours of the time it filed the requisition. When repairs would require more than 24 hours the plane automatically was retained from the maneuvers.

In order to fill an order promptly and reduce the time a given plane would be unserviceable, the supply division operated eight Douglas C-1 transport and landers at approximately two-hour intervals between the depot and the supply headquarters in the field. On the last day the planes were at Springfield, Boston, and Fairfield, and the supply transport made fourteen round trips between them and Middletown.

Everything was carried up to the ground and was for the most part in the green, and wings for the pursuit and observation planes, were seasonal issues in the corps. On one representative day there were 154 requests from Middletown, each request averaging an average of more than ten days. On another day four engines were delivered by Standard Transport. Included in the supply planes was one C-1 fitted out with a wireless set and other repair apparatus, this was the only answering calls from the various fields.

Few extensive repairs

Thursday, May 28, was assessment day in the program—namely the regular weekly check of engines and planes as carried out at New York Corps. Planes were washed, engines checked over, spark plug checked, and larger hose repaired or replaced as needed, and the equipment was remarkable little extensive replacement and maintenance was required. Up to the next plane left the New York Corps for Washington and nearby points only eight machines had been landed to return completely from the maneuvers. Two were machines, one was a major overhaul which the depot would have to handle. Only two planes had required major replacement, such as the substitution of motor cylinders, wings, etc. They concerned in the engines. The mechanics did extensive work with the last lot, such planes were repaired to have included a complete connecting rod assembly made by hand-operated machinery. The general organization was of course an utterly exceptional military unit with an almost negligible ability to do any sort of work which demands



the division of the General Staff. "You say you used the information division?" said an old soldier standing at Fairfield. "We have no such division. Do you mean G-2?" If a division could have been made, it would have been that there was too much centralization of staff work. When the staff arrived everyone landed exactly what was going on and what was to be done next, but spending time arriving a dog of uncertainty here over the area of operations and the staff could only be in one place at a time. While the division was on the way from the Middle West to New York, the most direct center of all of the field and military headquarters in the neighborhood of the city produced less information about the movement and the probable time of arrival than could be had from any New York newspaper office.

Shortage of clerks a handicap

In spite of the long period of preparation available the commanding officer and his staff labored under many disadvantages, one of the most serious being a shortage of clerical help. Officers of all ranks were to be found possibly looking over their own accounts and reports on their own typewriters. Arrives in the field and spent considerable time in the morning before Eisenhower's Staffs located the writing-machine, and realized that an officer unable to find his efficiency at the moment of war would inevitably be misled, as they were in the late conflict, for several weeks everywhere except in the field.

The shortage of clerical help was not apparent as much for the Army engaged in peacetime maneuvers as they did in war. The Army engaged in peacetime maneuvers had a large staff of stenographers and typists for Air Corps whose work would be likely to be much more somewhat practical than in war. The Army engaged in peacetime maneuvers had a large staff of stenographers and typists for Air Corps whose work would be likely to be much more somewhat practical than in war. The Army engaged in peacetime maneuvers had a large staff of stenographers and typists for Air Corps whose work would be likely to be much more somewhat practical than in war.



When a service switch which just as planning line represented was being used, the machine was not in the line. Below: Practice supply lines were established in their way having assembled machine to receive the troops' requisition and carrying material that arrived with the squadron.

was flying by the Air Corps and the squadrons of small aviation but come to be taken for granted, but actions if ever before have long-term landings and take-offs been practiced with such large numbers of planes, with squadrons coming in as such close succession, and on individual planes. Even when the ground was full of supply spots and path of wires, landings, with made in due formation. In a typical landing the first hundred or so planes, and another squadron was landing 40 seconds thereafter. Three minutes after the appearance of a group of 50 machines over Mitchell Field they were all parked in a single row along the white-washed line laid down for each squadron.

The same thing was done to help maintain front ground personnel, was even more spectacular than the formation flying. A score of machine pilots, sometimes landing into what looked like an impossible angle, were steady and quickly rising into column and then brought to the position, so much more quickly within inches of the exact location, that had been marked out for them. The air and the ground were a single unit, more than to any other feature of modern warfare design the maneuvers were their success and in some-power on the ground which could be set directly to the credit of the brakes and brake controls were in calculable laps.



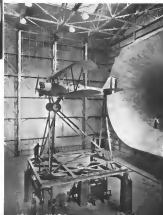
Behind 25,000 hours of flying, more than 200,000 were this (left). Top: The minutes after starting a climb by leading short of the field. Bottom: Two hours later.





Almost View into the full cone of the wind tunnel showing the diffuser, generator and the starting wall before them. Right: A Wright biplane mounted on the balance. The streamlines of the supporting struts shown in the upper picture were spotted after this photograph was made.

The N.A.C.A.'s
great wind tunnel
and towing basin
at Langley Field



Left: Ready to test a flying boat hull mounted in the new towing basin. Note struts supporting, and the generator above. Below: A general view up the 1,200 ft. duct.



For the first time in aerodynamic research history, tests of a full scale airplane are to be made in a wind tunnel sufficiently large for this purpose. This tunnel, which is by far the largest in the world, has just been completed at Langley Field and, together with a recently constructed towing basin, also of gigantic proportions, was dedicated during the recent N.A.C.A. Conference.

Aeronautic progress and the N.A.C.A.

ON THE threshold of what promises to be an unparalleled period in the history of aerodynamic research, the personnel of the N.A.C.A. Laboratories at Langley Field, Va. passed on May 27 to welcome informed representatives of the aeronautic industry to the Sixth Annual Aeronautic Engineering Research Conference. Important to past conferences of this sort have been, the most recent meeting may be characterized as the most significant of all, for it was marked by the dedication of two new pieces of equipment that should conduct successfully to the state of aeronautic knowledge. The inventiveness and resources involved in applying data based on model tests to full-scale tests are too well known to need comment here. For the first time in the history of aerodynamic research, it is possible to test a full-sized airplane in a wind tunnel under controlled conditions. The new full-scale wind tunnel offers possibilities for research which have hitherto been unattainable.

In the field of flying boat and seaplane design also, accurate data have been cyclic inadequate due again to the physical limitations of available testing equipment. Towing basins for models of ship hulls have been in use in this country and abroad for a relatively long time, but with the advent of the flying boat whose characteristics are mostly different from those of ordinary surface craft, tests in avoiding water obstacles have been generally over wind-tunnel. The new towing tank at Langley Field was designed and built primarily for a study of seaplane hulls. Its size and speeds available for towing are so much greater than those of any similar piece of equipment that it should open up totally new fields of research. The planning in construction of these two major pieces of equipment marks a very far

more in aerodynamics, of almost significance to the entire industry.

The industry listens

AFTER a brief address of welcome by Dr. Joseph E. Ames, chairman of the Committee, Elton W. Miller, chief of the aerodynamics division first commented on a systematic study of airfoil profiles undertaken by E. S. Jacobs and John Stock in the variable density wind tunnel at high Reynolds Numbers. An analysis of sections which are most widely used has indicated that they are all very much alike except in number and thickness. By selecting sections which are in popular use today such as the Clark Y and the Göttinger 398, and reducing them to a symmetrical section of zero camber, a surprising uniformity of outline exists. For the so called symmetrical section it has been found that maximum lift is obtained for thicknesses ranging from 22 to 18 per cent of the chord, and that the minimum drag varies uniformly with thickness, being twice as high for a section whose thickness is 22 per cent as it is for one with a thickness of 5 per cent of the chord. Preliminary results have indicated also that a section with a mean camber of 6 per cent, with maximum camber located at 50 per cent of chord and with a thickness of from 8 to 12 per cent, would yield maximum values of lift for the same increase in drag as compared with the basic symmetrical section.

The investigation of nacelle location with respect to a monoplane wing has been continued during the year with every indication that nacelle forced

completely into the leading edge of a wing are considerably better than the disadvantages of high speed and excessive shock due for any other of the twenty positions above or below the wing which have been studied. In order to check leading characteristics, tests have been made on wing and nacelle combinations with propellers rotating and with propellers locked, and it has been indicated that the lift is very little affected under such conditions.

Mr. Miller concluded his portion of the discussion with a description of the work which is being done in the propeller research tunnel on an exceptionally large model of the new airplane Albatross, and a description of airplane spinning characteristics. In connection with the seaplane investigation, drag data on a number of ship hulls have been obtained which indicated that the minimum drag is to be expected with a fineness ratio of approximately 6:1. Decreasing fineness to 2:1 or less would increase it to 10 percent as against the drag of approximately 180 per cent. In connection with the spinning characteristics, it has been indicated that important spinning may be eliminated for all commercial airplanes by proper stability and control at high angles of attack. In general, increasing the moment of inertia about the Z axis and decreasing it about the Y axis would be of aid spinning resistance. The danger of spinning is sure it is sometimes important but it is not always a menace as the world knows.

Following Mr. Miller J. W. Crowley, chief of the flight test section described some of the full scale investigations, which were being made in connection with the building up of the wing in flight and the effect of various wing

Three commercial autogiros

The Pitcairn and Kellett machines,—a comparative study of their proportions and structure

NO LONGER is the autogiro a seven days' wonder. It has become a commercial product. With the announcement of the Kellett two-seater, of which this is the first detailed release, there are two manufacturers definitely in the field, offering three standard models at fixed prices. A third, the Buell Aeronaut Corporation, has taken a license, but has not yet produced a machine. Up to the first of June eight Pitcairns were shown, all of the PCA-2, 300-hp models, had been built under an approved type certificate has been issued on the Kellett, and both that and the Kinner-powered Pitcairn are going into production in small lots. The major characteristics of all three models are tabulated in Table I on the page opposite.

The field is an open one. The Autogiro Company of America, Inc., of Los Angeles, Calif., is the American rights owner. Since de la Cierne's patents, has been prepared to give license to responsible applicants on fixed terms. A great deal of actual construction has taken place at the customer's side by sale of the Autogiro Company of America and Pitcairn Aircraft, Inc.,

autogiro builders. It is generally assumed that they are intimately connected with each other.

As a matter of fact, the two companies are very extremely kept separate, and make contact only through their common counsel by Harold F. Pitcairn, original American autogiro leader. They have no operating personnel in common, and the Pitcairn designs are now being prepared by the Pitcairn staff, headed by Walter C. Clayton, chief engineer, exactly as those of any other licensee might be. The parent, parent-company grows its own staff, and admits whose taught in nature of general principle, but it does not dictate

their position, nor does it engage in detail design work. Comparison in the personnel roster of the Autogiro Company, aside from Mr. Pitcairn himself, are: Geoffrey S. Chubb, executive vice-president; E. T. Ashford, vice-president; Agnew E. Barnes, chief engineer; James G. Ray, better known to the aeronautical world than any of his associates for the spectacular demonstration that he has provided at many eastern airports and international exhibitions, vice-president and test pilot.

The appearance of the autogiro has become familiar in the northeastern states, and especially in the neighborhood of New York, Philadelphia, and Detroit. The general behavior of the type is well known, but the theory is still a profound mystery to most of the amateurs, even though they are qualified engineers and airplane designers. As they seek to understand it, their mind's tendency has been to simplify it too much, to supply analogies that have no basis, and usually to dismiss the essential features of the machine on the presumption that they represent merely the artistic taste of the designer.

Thus, one often hears it said that the



Two Pitcairn PCA-2s over New York Bay. Below: The Kinner-powered PCA-1

small fixed wings with upturned tips which extend out from the bottom of the fuselage have no function except the support of the airframe. As a matter of fact, they are essential to proper operation. It is often assumed that the rotor is merely a propeller carried in full because somewhere approximately above the center of gravity and on the plane of symmetry of the fuselage. As a matter of fact, its position and attitude and the proportioning of its parts, including the odd angles at which its axis is offset both longitudinally and laterally, have to be determined with the utmost nicety. They offer a dynamic problem for which there is no counterpart in airplane design. Aeronautical experts with a job for engineers, studying the autogiro's functioning, have measured it up in a phrase as "nothing more than an airplane in a combination

but spin." No parallel could be more inexact. The essential characteristics of the flat spin is that the angle of attack is accurately large, far beyond the stall. One of the most essential characteristics of the autogiro's behavior is that the rotor blades are never stalled except on

their innermost portions. The effective parts of the blade work, for all flight speeds and conditions, within a surprisingly narrow range of angles of attack.

There is no idea of giving an elaborate explanation of autogiro theory at this point, nor any explanation of all except consider as it controls design characteristics and it necessary in order to understand design process. A great part of the autogiro structure involves no general principles new to the airplane designer—power plant and mounting, landing, landing gear, tail surfaces, and engine controls.

Though all these elements are also in some and in purpose to parts of an airplane, their design is of course affected by the fact that it is to an autogiro that they are being applied. The familiar concepts and rules developed through 25 years of airplane experience cannot be directly applied. A new body of experience is being obtained, and a new set of design standards developed. Thus, for example, there are noted the conspicuous differences in the proportions of the fuselage and landing gear.



The Continental-powered Kellett

Table I: Major characteristics of the two Pitcairn and Kellett autogiros

	Pitcairn PCA-2	Pitcairn PCA-1	Kellett
Gross weight (lb.)	1,250	1,100	1,000
Weight empty (lb.)	1,000	975	1,000
Maximum useful load (lb.)	400	100	0
Seating capacity	2	1	1
Engine	Continental	Wright	Continental
Engine power	125	100	85
Engine diameter (in.)	27	34	36
Weight per horsepower	14.8	10.5	11.7

Performance (reported by manufacturer)

Maximum speed (mph)	52	75
Maximum speed at best flight (in mph)	28	4
Rate of climb at sea level (ft. per min.)	0	0
Service ceiling	10,000	10,000
Controlability (in vertical landing) (in ft. per min.)	11	0

that is an surplus of like size and performance.

The Pitcairn machine has a normal stator adjustment convertible from the rear cockpit. The major is from 0 deg. to plus 4 deg. to the leading edge.

The designers of the Kellert machine have adopted an alternative arrangement for the adjustment of longitudinal balance. The stabilizer is fixed but the control system incorporates a highly specialized type of adjustable hinges, best to be understood by reference to the drawings on page 411. It differs from an ordinary aircraft hinge in that the moment arm at which the spring works increases as the displacement of the controls are increased. To ease the adjustment is set to pull the stick back, for example, giving the effect of an elevator, the fulcrum is very small when the stick is near its central position and gets steadily larger as it is allowed to come further and further back. The adjustment thus serves as one of the purposes of an adjustable stabilizer and of a balanced control system.

There remain for consideration the parts peculiar to an actuator, the fixed wing and the rotor and its mounting and control.

Function of fixed wing

As has already been suggested, the properties of the fixed wing, small though it is, have a very definite effect upon performance. Were it not for the fixed surface the rotor speed would vary inversely with speed of flight, increasing at high speed and decreasing at low. An inched adjustment of the fixed surface, on the other hand, might have the opposite effect, the rotor slowing down dangerously during a dive. The fixed wing is so proportioned, as to its area, its curved surface, and the angle at which it is set upon the fuselage, that it will rise an increasing share of the lift as the speed increases, so reducing



The hub assembly and motor gear complex

the load on the rotor and making it possible for it to continue to do its share without change of speed. The Autopilot Company's estimate of the part of the total load carried by the fixed wing for a machine of the Pitcairn's proportions is 21 per cent at maximum speed, dropping off to 8 per cent at minimum speed, at horizontal flight. For the Kellert with a considerably larger fixed wing, the corresponding estimate would be 32 and 14 per cent.

The large Pitcairn machine has a fixed wing area of 50 sq. ft. at an area of 86 sq. ft. projected in the horizontal plane. This includes the aforesaid. The area of the fixed wing area is the rotor disc area is 0.05. The smaller Pitcairn has 52 sq. ft. in the same, and the area ratio is 0.06. In the Kellert model the area of 120 sq. ft. gives a ratio to the disc area of .076. The difference of area ratio represents a difference of opinion between the two design staffs about the best means of securing maximum efficiency and keeping a constant rotor speed. The models differ also in the general form of the wing, that on the large Pitcairn machine being sharply tapered from a root chord of 12 in. to a tip chord of 30 in. the 300 hp machine, while the Kellert has a constant chord of 34 in. The span of the fixed wing is 30 ft. on the large Pitcairn, 22 ft. 9 in. on the small Pitcairn, and 30 ft. on the Kellert. The aspect ratio is from 8.7 to 9.4 on the Pitcairns, and

this value is only 5.2 on the Kellert.

The wing of course has the responsibility of providing lateral stability in a stall, and it must act promptly, in turning the tip up to ease a slip stall with very low forward speed and correspondingly ineffective control. It should serve also to give a proper bank in giving suddenly into a turn of high speed, compensating for the lack of high lift area and the consequent tendency of the machine to yaw to bank in the wrong direction in the result of stalling when the rudder is sharply applied. As in an airplane, dihedral is the obvious expedient in such a case, and it has been externally employed—5 deg. in all cases, with about 2 ft. of either dip curving up another 15 deg.

The wing structure, serving as an anchorage for the landing gear and tail-



The rotor hub and mounting on the Kellert-mounted Pitcairn. The rubber blades restrain members of the blade around the vertical hinge pin axis located at A



The rotor hub's horizontal alignment, with bushings for the horizontal hinge pin in place

ing the full landing impact through the shock-absorber thrust at a distance of about 5 ft. from the wing root, is made very solid. It is rigidly braced at the point of landing gear attachment, by wires in the Pitcairn and by diagonal struts from the upper fuselage to the

Kellert, and reinforced beyond these points. The structure is made that of an airplane wing, a wooden skeleton covered with fabric. The weight of the wing, including struts and external bracing members makes up no more than about 55 per cent of the total wing weight. The load factors for which the fixed wing is designed are similar to or a little above those ordinarily required for the wings of conventional airplanes.

Even the fixed wing has a close analogy in the airplane, but in construction the rotor wing is wholly new ground. There is nothing about its design except for the use of an aerial section in the blade, to suggest the older and better-known type of biplane-than an airfoil.

The rotor assembly in general

To summarize very briefly what is common to all existing autogyros, the rotor is an assembly of four blades joined to a link which turns freely on a shaft. It is carried by three S.E.P.



The hub of the Kellert rotor assembly. The blades are mounted on the hub in the horizontal plane, the aerodynamic forces for the rotor



The lower end of the Kellert rotor and a sketch to show its attachment to the bearings

ball bearings, two pure radials, and one all radial thrust or angular-contact type. The shaft is mounted on top of a yoke at three axial points, spreading out from the base of the shaft to their well-separated points of attachment on the bearings. Although the rotor naturally turns freely, and always does so when in flight, it, with its mounting on the yoke, is subjected to torque in both directions under special conditions.

The positive torque is applied by the mechanical gears, at which axis least the negative torque by the brake used to bring the rotor to rest after landing.

The rotor blades are set at a static angle of only about 2 deg. to their direction of travel when the machine is at rest. As the blade is bank upward in a turn, the angle of attack becomes a positive angle, but, however, its horizontal rigidity is limited, and the effective angle is increased approximately from 2 deg. to 4 by blade flexion. The actual angle

at which a blade enters the air is therefore further increased by the fact that the rotor is at a positive angle to the flight path when in normal flight. The elements on the outer third of the blade actually work at angles of attack ranging from 4 or 7 deg. in normal flight down to about 4 deg. at maximum speed.

It is undesirable to set the rotor at a large angle to the fuselage because of the air resistance difficulties already described. The rotor axis is inclined slightly back at a perpendicular to the fuselage axis. The angle of an autogyro in a given downward tilt of about 6 deg. in order to bring the thrust-line through the C.G. is a positive longitudinal stability.

The rotor blades are of course very narrow and of high aspect ratio, and carry only a small part of the drag weight by the rotor. The actual mass of blade area so far as is called the "solidity," and is approximately 1 m in all cases.

Returning to the rotor hub and examining the mounting of the blades, is

Table 1—The rotor blades

	Pitcairn P-24	Pitcairn P-25	Kellert
Blade diameter (in.)	37	40	41
Blade disc area	1,076	1,108	1,140
Blade blade wing	98	124	118
Coefficient of lift/blade	—	300	197
Normal rotor p.p.s.	141	140	133

changing two marks from the normal 90 deg. A further restraint against oscillation of the blades on the rotor plane ("flap") in this construction is of course only an approximate term, as the rotor blades are normally describing a very flat circular motion at all times. It is provided by blocks of rubber or fitted into the blade attachment so as to resist any movement about the vertical hinge-point of the universal-joint connection.

The rotor link brings into the picture another company, the last of the autogyro group. The Autopilot Specialists Company has been formed by Mr. Prentiss, with Mr. Joseph Perkin, well-known Philadelphia consulting engineer in direct charge of design in chief engineering, and in charge of business those parts that can be best made in a precision machine shop. The outstanding example is of course the rotor hub, Rick Pitcairn and Joseph Perkin.

where their hubs and their rotor steering mechanisms from the Autopilot Specialists Company's plant.

The hub is so designed as to permit the removal of the rotor in a whole, including all suspension cables and bearings. Instead of pulling the bearings off the side when the rotor is to be lifted, the side shell is taken apart at a part of the new and successfully is accomplished by inserting the jacking lever and all the side into a side about 8 in. in length which forms a rigid part of the entire assembly, and securing it there with a nut and turned-down washers, such as a propeller is held on its shaft. The side for the small Pit-



Rotor hub and frame shown on the big Pitcairn

The Chamber's safety conference project

An important step towards a worthy goal

INCREASED safety in all aspects of aviation has been a special goal for the Aeronautical Chamber of Commerce in recent months. Profound on by occasional alarming accidents, various sections of the Chamber have given such attention to the establishment of practices which would increase the margin of safety and in a rank, a permanent safety conference to replace all sections of the Chamber is being formed and a code of good practices has been prepared.

This national effort by the industry to provide feasible and careful methods of going about its daily tasks has a twofold purpose. Its chief aim is to lessen the loss of life and property. It also seeks to relieve the burden of early insurance coverage, through the establishment of an improved safety record. It is then an attempt to set the house in order for the good of its personal pocket book.

The Safety Conference, as organized by July, will be composed of one delegate from each member company. Because of the size of the conference, an executive committee will be appointed to handle certain aspects of its operations. The plan for the conference and draft of the safety code were prepared by individuals representing various sections and was approved by the Chamber's executive committee, a group which comprises all past presidents of the organization.

The code is expected to achieve its end through emphasis on the various rules and the means of carrying out or avoiding them. As the Chamber points out, the rules will for merely

common sense conduct. They would standardize the timing of additional parts, more thorough training and more strict training, so that the margin of experience and carelessness—the two states of mind which provide a terrific background for accidents—will be as evenly balanced as possible.

In another sense the code serves as the crystallization of the experience of many years of handling aircraft materials. If strictly followed, it would be practically impossible for any usual accident to occur. Much warning and recommendation has emerged from the severe laboratory of service operations in which the loss and livelihood of the individuals associated with an aviation emergency are directly involved. It thus provides a definite, dependable and practical guide for the industry to follow.

The code at present is concerned principally with the problem of fire protection at airports. Though numerous instances of opportunities for accidents exist at airports, that anywhere else in aviation, it would seem that transportation plants should rank in a fairly close second. Probably their shop hazards will come in for special attention later. However, in the aviation the maintenance and repair are merely asked to observe closely the Department of Commerce's recommendations regarding the production of aircraft and are required to well understand shop practices in the older craft, woodworking, and a

automotive industries. Various aspects of operations receive second largest attention while recommendations governing repairs and components are minimal in extent and nature to the prospects for modernization.

As it is to be expected, many of the recommended practices have a leveling ring. For instance, design and painting in storage hangars should be limited to painting only, and this work should be done near a hangar door or as far as possible from doors leading to the repair shop and rooms where there are open flames. The recommendations that during this design or painting at least one man with two extinguishers should stand by is not as familiar, nor is the suggestion that privately owned cars and tractors not be parked inside hangars.

Emphasis is placed on good housekeeping around the airport. The day of the corner plot in airplane restaurants and the indiscriminate storage of new parts and equipment in most parts has passed. Handling of fuel and lubricants should be in accordance with the practices worked out by the Fuel and Lubricants Section of the Chamber and government regulations will be strictly enforced.

An example of the code are the provisions to be taken in welding operations: (1) Extending and thorough examination of all quality and oil from tanks and systems; (2) Removal of fabric and wood for a good distance from spot to be welded; (3) Wrapping of all metal adjacent to the weld with wet rags; (4) Protection with asbestos blankets to prevent ignition risks; (5) Placing of a bucket of water in the vicinity of the welding; (6) Protection of all metal surfaces; (7) When possible, spot to be welded should be removed from plane.

The code at its present is a proposed law and is adopted to be by an agency complete. It will be the chief medium of expression on the part of the safety conference and, therefore, will be in a state of constant improvement in accordance with changing conditions and in the light of increased knowledge. As now formulated it represents a timely and valuable step toward the goal it seeks and it deserves the respect and loyalty of all acts of the industry.

Flying versus transportation



By Capt. Frank T. Courtney

THE general public does not want to fly and probably never will want to. About two years ago one of the best known air passenger lines was started and the impression that the public was going to return into its planes, but nothing of the sort happened. A railway station was inaugurated a few years ago and the idea was an interesting experiment, but it only led to the old air flow in through a different hole, and a prominent executive pronounced deeply that he had come to the conclusion that the public did not want to fly. His conclusions were correct, but his grounds were unwarranted. Nobody seems to go for a ride, but millions travel by train in a mass of getting somewhere. Often more than thousands of trucks, automobile buses who have the air, like the removal of trucks, usually want to get to the other side.

The only real commodity that aviation has to sell is very rapid transportation. Our nation where air transport is constantly slow, more things automatically become rapid transport, but where system has to compete with highly efficient transport (which is all that aviation is concerned with) it is useless to say so will save flying. All sorts of reasons are given why the public does not fly: expense, danger, unsatisfactory service.

new, and discomfort. But these are only details.

The real trouble is that air transport is so unpopular at present that it does not supply a public would. That is it does not supply a service to the public worth the price it would be compelled to charge in order to make it a reasonable trade. The operator, whether he realizes it or not, still continues to try to sell flying, which is partly the result, and partly the cause, of the imperfections of the passenger services. It is a result because some operators can't be able to offer a satisfactory service on the grounds of rapid transport alone work in their advertising work that is merely an accident to fly. It is a cause because

the operator, honestly believing that he is emergency his airline is obviously to possible, just seems to believe that his main task is not to improve the efficiency of his service, but to "blatant this public to fly." Hence he is working his substance in trying to make the public to buy an unwanted article instead of spending his money on making that article as efficient as to become a necessity. If that is not true, why do so many railroad people, well educated in flying, spend his money where they could be saving by air?

The present volume of air passenger traffic is interesting, and the gradual increase even more interesting, but it is still far from being a paying proposition and without compare with the days which it before are coming, when almost all first class passenger traffic will go by air.

The problem of cost

In a somewhat understanding the question of cost is presented in the industry it seems to receive the most casual treatment, on both construction and operation. First and foremost it

Efficiency and economy are being sacrificed today on the high altar of Speed. Captain Courtney's long association with transport problems makes his analysis particularly pertinent at this time when operators are seeking every possible means to stem the tide of red ink.

The speaker here at the Bureau of Standards, Washington, in 1929, is the interest of about safety



airlines to offer to take a man 1,000 mi. and lose only 30 to 40 lb. of baggage. On the other hand it is obviously impossible to carry great baggage loads free. At any rate, it might be possible for a passenger to take a reasonable load of baggage if he wants to pay for it. The load element of baggage accommodation of most passenger planes, therefore, provides for much more than the 30 lb. per passenger.

Many European passenger planes use accommodations other cabins, and many passengers pay for that service. Certainly any plane for twelve passengers or more ought to have such accommodations.

An increase of the conventional 30 to 40 lb. ought to be considered. I have frequently heard expressed, and have often experienced, great irritation at a comfortable package for what seemed almost enough baggage. It is a difficult question, but it would be greatly helped by a list of detailed examinations. In simpler offering services, transportation, however, the question of how much and what size baggage a passenger can take, how much he will have to pay for it, and where it shall be stored must obviously be added in the calculations of loads, speeds and baggage, and therefore in the original design.

Conclusions

It must not be assumed that the public is not yet ready for air transportation. The reverse is the case; air transportation is not yet ready for the public. That is the whole business is resolved.

As passenger operations are not merely flying to make money, they are being heavily in debt. In some cases, they could actually be making profits to be used, in advance the mail subsidy has had to be sought to prevent operations from running down with heavy losses. There are definite indications that the huge sums now being spent by the government on the air mail will be reduced, which is to it should be. There are many reasons why governments should and do support commercial transportation of various sorts by mail contracts—there is no reason why governments should repair losses which, there is reason to think, the operators could themselves fix, through greater commercial efficiency.

Program of the A.S.M.E. (Aeronautics Division) meeting at Baltimore

In other words, air transport companies must make more or less decisions on their passenger-carrying whether they have real contracts or not.

The reasons for the great losses to date are not far to seek. Many passenger lines have been initiated with little, if any, regard to the possible factors involved. Huge expenditures were made in the construction of planes, regardless of their preliminary profitability, speed, or load, merely because they were probably the best available. Some of these planes were put into mass production and sold below cost before there was any evidence that an operating profit might be made or even a profit. The result was not only to clutter up the airways with a superfluous of expendable planes, but also to put out of commission anybody who might stand a chance of showing better economy.

Large numbers of expensive planes were put into expensive operation before there was any reasonable indication that the public would use the services offered, and when these were shown to be unprofitable.

The original cause of the trouble seems to have been the idea that some thing had to be done, and therefore we had to use whatever was available. This might have been so in Europe, for in almost every case there was no military or political reason for having something running, for nothing and maintaining the new form of communication with distant dependencies and military outposts. In commercial America there was no reason whatever for starting passenger lines with expensive, research, and experimental airplanes, such as Americans get into other expensive undertakings, had given them something to go on.

Now, we have to do a serious amount of work. They do this with

the power they use. With the power available they must compromise between loads and speed. The loads limit in the money and the speed cost the money. One can have more load and speed, or less load and more speed. There is a tendency to ward too much speed and too little load, and, in my opinion, that is one of the main causes of our troubles.

As the main cause of our troubles is the use of the wrong design, instead of a closely balanced comparison of all factors concerning load and speed, there is a growing tendency to close-mindedness of super-efficiency in such projects as far-forward concepts, airplanes with everything inside the wings. Modern theory now practices shows any advantage in this sort of thing, yet it goes on at great cost. Let us by this sort of thing only when we have perfected the things we know, and have made some money out of them. Today everything points to the fact that we must have more of the load which cost the money. In my opinion this load directly to greater wing area than the load which is not used.

As to the disputed issue which, if the design is carefully considered, can give all and more than can be expected from more radical and even expensive developments. If dollars and cents, rather than "advanced" design were made the basis of commercial developments, there would be considerable change in the outlook on passenger plane design.

After all, the real commercial air transportation, extremely high airplane speeds mean little today. Real speed, not the thing speed, but the actual speed, is not yet in the air. It is being increased by improved operations and reliability, which will give us faster transportation for slower and cheaper flying.

AVIATION July 3, 1931

AVIATION July 3, 1931

A report of the Fifth Annual Technical Meeting at Baltimore

The A.S.M.E. discusses aeronautics

Sponsored by local engineering groups, the American Society of Mechanical Engineers held its Fifth National Technical Meeting in Baltimore on the three days beginning May 12. A total registration of 450 persons was recorded, including over 200 from outside the Baltimore district. Sessions were held at the Hotel Lord Baltimore, the Engineers Club, and the Curtis-Wright Airport. The discussion sessions provided all phases of aircraft design, construction and operation. The complex program, including a list of all paper's read, appears on this and the opposite page. In the following is a list of the outstanding papers presented as outlined from the various sessions will be discussed in some detail.

Operators compare notes

With the immediate prospect of increased restrictions to direct financial interests from the government hanging over their heads, airline operators are casting about every possible method of effec-

ing economies in the operation and maintenance of their equipment. Mr. F. T. Courtney, of New York City, in analyzing the situation in a "Comparison of Airplane Types from the Transport Standpoint" concluded that high speed is not often considered the primary requirement, and even production cost and carrying capacity and passenger comfort. Once these latter factors are given their proper consideration, he believes that economical considerations will direct the trend of design for purely transport types at least from the present date on. He pointed out several new class customer monoplane designs, with their high wing loadings and somewhat high landing speeds, toward the other extreme. He stressed the need for wing sections. He raised the issue as to whether or not designers today were going too far in increasing airspeed, and even in airspeed on

planes, merely for the sake of being modern without really solving one of the most serious factors involved. His studies had led him to the conclusion that the highest wing efficiency was being used to provide maximum landing speeds, and having suitable, water-cooled power plants were nearly ideal current transport requirements thus any other factor type. This statement, presented before a group of airplane designers naturally led to some difference of opinion, which was finally expressed.

Following operations, as contrasted with Mr. Courtney's discussion of economy in selection, was the theme of "Aircraft Servicing Problems" by Charles French, general service manager, Pullman Aircraft Corporation of America. Servicing airplanes falls into two categories: (1) maintenance of service, including technical field service, supply of parts and operation of servicing stations; and (2) operator's service, involving maintenance facilities, airplane and engine overhaul and the selection and management of shop mechanics. Under present conditions the first requires

from the manufacturer's point of view in the establishment of a good factory servicing system, with responsibility for all possible branches. A good service design for the control system should be worked out, taking all factors of transportation and handling, storage, parts distribution, and repair facilities into account, and the removal stations based on the same design, making allowances for the requirements of early load equipment. The administration of the factory servicing system should be under the control of the sales representative, and the service work inspection together. The selection of the field personnel is

Monday, May 11, Morning
General Session: "An Analysis of Various Airplane Types for Transport Use." Prof. F. T. Courtney, "Maintenance of Transported Aircraft." General Session: "Aircraft Servicing Problems." Charles French, Pullman Aircraft Corporation of America. "Maintenance of Transported Aircraft." Prof. F. T. Courtney, "Maintenance of Transported Aircraft." General Session: "Aircraft Servicing Problems." Charles French, Pullman Aircraft Corporation of America.

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ventures, and the only other necessary modification was improvement of the landing gear to provide the airplane to be loaded at its maximum weight of 6,000 lb without damage. The detailed results of the test are to be published shortly by the NACA. The Navy has also made some experiments with special fuselage of elevator control, but they have not proven entirely satisfactory because it is often doubtful to make a full static loading in exceptionally rough water. T. P. Wright said from a recent flight that he has never had any experience in flying an airplane in which the doors were open on one side and closed on the other, and the latter described a flight test on a Curtiss Super Hawk in which he was able to hold the airplane at such a speed that the conditions described by Mr. Wright took place. No difficulty was experienced in keeping the airplane on its course and he did not believe that it was necessary to discontinue the test until completely satisfactory. Mr. Wright asked about the possibility of spoilers as a means of control on the flap gear, and Lieutenant Hopper stated that he believed that spoilers were due to come into more general use as these devices were more widely known. They offer considerable advantages in lateral control, particularly in recovery from spinning. He pointed out, however, that it is absolutely necessary to equip spoilers with a positive

control as some difficulty has been experienced with improperly fitted spring-actuated spoiler control.

Prof. Alexander Klemin of New York University read a paper by James Briggs of the United States Coast Guard, analyzing the motion of an airplane in flight and the effect on paratroppers. He considered that the main source of difficulty in the air was not from rolling or yawing motions, but from vertical oscillations of the center of gravity and from pitching motions. He outlined several theoretical possibilities for overcoming this defect without increasing in detail the present methods by which they might be controlled. Mr. Wright pointed out that the question of an motion was at great importance among the transport operators and the question was raised whether high speed aggravated either these or the other effects. It was the general opinion that if the direct causes of discomfort were so described by Mr. Briggs, they would be appreciated rather than reduced as the speed increased. For the effect of slight changes in incidence on the lift would be magnified as the speed was increased.

Mr. W. L. Miller of the B. F. Goodrich Company presented a study in stability tests leading during a sudden pull up. He commented on the inadequacy of the data on which historical tail sections had been designed, and indicated that by the usual methods it is very easy to introduce errors of the order of 10 per cent. His analysis had indicated that the mathematical statement is highly necessary in the design of tail surfaces and that the usual practice of depending on average loadings over the tail only rarely gives adequate in certain cases where extremely high loads concentrate on the tail surfaces. He indicated that his theoretical study of pull-up conditions agreed very closely with the results of flight tests made by the NACA. The full details of Mr. Miller's paper will be available for publication in the near future.

The business airplane

Aside from possible publicity benefits, the commercial value of the airplane which is quickly diminishing, the one aspect which will be given a hearing only by American business organizations in favor of their making use of privately owned air transport is that of definite delivery and certain storage and it is obviously impossible to demonstrate strongly without a full knowledge of what it actually costs to use and operate. There have been few reliable data compiled on this subject. An analysis of costs is particularly timely. About a year ago, Air Engineering and Advisory Service, Inc., of which Mr. Jerome Lockner is vice-president, prepared a three-page study which

with a seven-cylinder, 225-hp radial engine. Two models have a constant speed of the same type, however, and both places have been used to report aviation insurance rates in all parts of the United States. Complete cost data were kept on the two airplanes, and accurate figures are available on all items of expense. The results of Mr. Lockner's analysis are in Table IIA and IIB. The former shows how total cost and cost per mile vary with the number of hours flown per year, and the latter shows the relative importance of the various items which enter into the total cost for various hours of usage of the airplane. It will be noted that the largest item in Table IIB is the overhead pilot's pay and expenses, but it may safely be assumed that no plane is operated which is more dependable and easier to fly, the relative importance of this item will be materially reduced.

For formation and spinning

One of the greatest hazards to flight under adverse weather conditions is the formation of ice on wing surfaces and propellers. Mr. William C. Geer, research scientist, reported on work which he and three assistants at the National Air Transport Company and the B. F. Goodrich Rubber Company is attacking the problem. It has been demonstrated that the removal of ice from airplanes can be accomplished practically by the use of a permeable rubber coating applied to the leading edges of wings and tail. The rubber coating is a chemical treatment to reduce the adhesion of ice, and as such which is broken up by periodically rubbing the surface with air. Although results have not been positive in removing ice from small wings or from propeller blades, considerable research work is being done in this direction, and undoubtedly that some practical solution will be reached in the near future.

Mr. Robert H. Williams of the Department of Commerce outlined the history of the study of tail spinning and indicated that the investigation of the Department had been completed that there were four factors which in most cases determined spinning characteristics: (1) the machine should be stable about all three axes; (2) the wing loading should be well forward with respect to the center of pressure; (3) the wing loading should be kept below a certain maximum limit which is controlled upon the characteristics of the airfoil used; and (4) weight of airplane and cargo should be grouped so closely to maintain the center of gravity. Undoubtedly Mr. Whiting had plans in the planning of the Department. As an operator, while manufacturers have been slow to accept the Department's findings, they have been slow to accept the Department's findings. They have been slow to accept the Department's findings.

Used airplanes

The method of a California company which successfully deals in them should be of particular interest to aviators



which is adapted to be a particularly handy way, actual photographs are sent to the prospective purchaser, illustrating the airplane as well as its story told. These photographs are made by the company with its own camera and its own airplane. The latter is a small airplane, but it is a very good one. The latter is a small airplane, but it is a very good one. The latter is a small airplane, but it is a very good one.

When it comes to conducting a constant solution by mail, we estimate that the company has a large stock of used planes on display in a hangar in Citrus County, for example, which is a small airplane, but it is a very good one. The latter is a small airplane, but it is a very good one. The latter is a small airplane, but it is a very good one.

Two advantages are kept out of the territory all of the time, traveling the eleven western states to search out new prospects and to follow up those who have been contacted. These are sent by train or private auto and carry with them a handbook in which is listed the complete list of advertisements on each place offered for sale. In addition to these valuable data, the salesman carries actual photographs of the planes, showing their present condition, and also carries a complete set of merchandise's catalogs covering the price of planes listed.

No payment is handled unless it is a favorable condition. When mechanical work must be done on the plane at the time, the work is turned over to the local mechanic. The latter is a small airplane, but it is a very good one. The latter is a small airplane, but it is a very good one.

Table IIIA
This table shows the operating cost per mile and how they divide on the cost increase due to the greater weight of the plane from extra seats.

Weight per seat	Total weight	Cost per mile
100	1,000	1.00
150	1,150	1.15
200	1,300	1.30
250	1,450	1.45
300	1,600	1.60

Continuing the table to 350 lb, the cost per mile would be 1.75 cents, and at 400 lb, it would be 1.90 cents. It is obvious that the increase would probably be higher than is shown by the table.

Table IIB

Daily fixed cost	Percentage of total cost
100	10.0
200	20.0
300	30.0
400	40.0
500	50.0
600	60.0
700	70.0
800	80.0
900	90.0
1,000	100.0
1,100	110.0
1,200	120.0
1,300	130.0
1,400	140.0
1,500	150.0
1,600	160.0
1,700	170.0
1,800	180.0
1,900	190.0
2,000	200.0
2,100	210.0
2,200	220.0
2,300	230.0
2,400	240.0
2,500	250.0
2,600	260.0
2,700	270.0
2,800	280.0
2,900	290.0
3,000	300.0
3,100	310.0
3,200	320.0
3,300	330.0
3,400	340.0
3,500	350.0
3,600	360.0
3,700	370.0
3,800	380.0
3,900	390.0
4,000	400.0
4,100	410.0
4,200	420.0
4,300	430.0
4,400	440.0
4,500	450.0
4,600	460.0
4,700	470.0
4,800	480.0
4,900	490.0
5,000	500.0
5,100	510.0
5,200	520.0
5,300	530.0
5,400	540.0
5,500	550.0
5,600	560.0
5,700	570.0
5,800	580.0
5,900	590.0
6,000	600.0
6,100	610.0
6,200	620.0
6,300	630.0
6,400	640.0
6,500	650.0
6,600	660.0
6,700	670.0
6,800	680.0
6,900	690.0
7,000	700.0
7,100	710.0
7,200	720.0
7,300	730.0
7,400	740.0
7,500	750.0
7,600	760.0
7,700	770.0
7,800	780.0
7,900	790.0
8,000	800.0
8,100	810.0
8,200	820.0
8,300	830.0
8,400	840.0
8,500	850.0
8,600	860.0
8,700	870.0
8,800	880.0
8,900	890.0
9,000	900.0
9,100	910.0
9,200	920.0
9,300	930.0
9,400	940.0
9,500	950.0
9,600	960.0
9,700	970.0
9,800	980.0
9,900	990.0
10,000	1,000.0

Table 1: American landplane specifications

Including only planes with approved type certification—Aviation does not assume responsibility for the figures given
CONTINUED ON PAGE 114

Manufacturer	GENERAL			POWER PLANT			WEIGHTS			PERFORMANCE		
	Designation	A. O. No.	Year of Entry	Typical	Rated	Max. Take-off	Empty	Max. Landing	Max. Ramp	Max. Ramp	Max. Ramp	Max. Ramp
PASSENGER PLANES WITH SEATS FOR FEWER THAN FOUR PERSONS												
Boeing	Boeing Stearman	1	1925	100	100	100	100	100	100	100	100	100
Curtiss	Curtiss Robin	2	1925	100	100	100	100	100	100	100	100	100
Grumman	Grumman A-1	3	1925	100	100	100	100	100	100	100	100	100
North American	North American A-1	4	1925	100	100	100	100	100	100	100	100	100
Republic	Republic A-1	5	1925	100	100	100	100	100	100	100	100	100
Stearman	Stearman A-1	6	1925	100	100	100	100	100	100	100	100	100
Waco	Waco A-1	7	1925	100	100	100	100	100	100	100	100	100
CARGO PLANES WITH SEATS FOR FEWER THAN FOUR PERSONS												
Boeing	Boeing C-1	1	1925	100	100	100	100	100	100	100	100	100
Curtiss	Curtiss C-1	2	1925	100	100	100	100	100	100	100	100	100
Grumman	Grumman C-1	3	1925	100	100	100	100	100	100	100	100	100
North American	North American C-1	4	1925	100	100	100	100	100	100	100	100	100
Republic	Republic C-1	5	1925	100	100	100	100	100	100	100	100	100
Stearman	Stearman C-1	6	1925	100	100	100	100	100	100	100	100	100
Waco	Waco C-1	7	1925	100	100	100	100	100	100	100	100	100

Flying Equipment

THE FORD FREIGHTER

LONG a proponent of the tri-engine airplane for passenger transport, the Ford Motor Company of Dearborn, Mich., has placed on the market a single-engine airplane, primarily for freight and express-carrying purposes. The new design, although based on recent tri-engine practice in fuselage construction and its layout, the Liberty-powered Ford of 1928.

Of the seventy odd airplanes exhibited at the Detroit Aircraft Show last month the Ford freighter was the only example of an airplane equipped with a liquid-cooled power plant, its single engine being a 650-hp. Hispano-Suiza, 53-cylinder vee type. The radiator, also of the vee shape, is located in the underside of the fuselage well back from the nose sheet under the pilot's cockpit. Temperature control shutters are provided and a generous fairing carries the line of the radiator well back into the fuselage. A four-blade wooden propeller of relatively large diameter is fixed to the engine working in a tractor

in the absence of the onboard engine nacelle, the vertical landing gear struts with the usual Fordish shock absorbers are carried upward into the center section of the wing. Large fairings are provided at the points of attachment. Aside from the changes accounted for by the new power plant arrangement, the Ford freighter is of the same general dimensions and type of construction as the three-engine model. This airplane is said to have a pay load of 5,000 lb.



The Ford

with an empty weight of 5,000 lb. and a gross weight of 15,000 lb.

THE SAVOIA S-31 AMPHIBION

OF the same general type as the well known S-30 Model, but carrying greater horsepower, and embodying certain refinements in design, the American Aeronautical Corporation of Fort Washington, N. Y., exhibited the new Model S-31 at the Detroit show. The machine is essentially a hull type flying boat with retractable landing wheels.

The wing outline is of the conventional biplane type and the power plant is carried in a nacelle below, and faired into the center section of the upper wing.

The propeller is arranged as a tractor. Seats for three persons are provided in a nacelle immediately below the engine nacelle, one pilot's seat in front, both equipped with controls, and the other placed immediately behind the other two without provision for control. Baggage space is provided behind the rear seat.

The power plant is a Krantz V-8 of 125 hp. The general characteristics as given by the manufacturers are as follows:

Span upper wing	56 ft. 3 1/2 in.
Span lower wing	33 ft. 8 1/2 in.
Length nose to tail	36 ft. 8 in.
Height wheel to wheel	37 ft. 2 1/2 in.
Wing area	64 sq. ft.
Wing area	194 sq. ft.
Weight empty	1,000 lb.
Gross weight	3,000 lb.

HAWKER FURY BIPLANE

A COMPLETE British Royal Air Force Sparhawk (No. 43) has just returned in full equipment of service of the new Hawker Fury single seat monoplane.

can planes. This machine is a single-engine biplane built mostly of steel and aluminum. It is fitted with a Rolls-Royce Kestrel S engine in a detachable mount. The fuselage is of steel and aluminum tubing interconnected by flat plates and tubular struts, the wings of high tensile steel string spars with duralumin or wooden ribs. A simple gear struts is used, top and bottom flanges being pulled down one step, interconnected by a web and controlled by new automatic machinery.

Low landing speed and high powers of maneuver are features of this machine and R. A. P. pilots are agreed that it is extremely easy to fly. The experimental type appeared during the official trials at Martlesham Heath a speed of 214 m.p.h. and the climb to 20,000 ft. was done in 15 minutes with full military load.

The Hawker Fury is the latest type of "interceptor fighter" to be used for the Air Defense of Great Britain.

New machine of the British



THE McCLEARY MONOPLANE

A FOUR-PLACE cabin monoplane of unusual design has been built and set down by Mr. Earl McCleary of South Gate, Cal. The machine is a pusher type, powered with a 100-hp. spirit. Curtiss engine mounted above and in the rear of the center section. The closed cabin is suspended below and forward of the wing and the tail surfaces are carried on a narrow transverse fuselage

structure attached to the lower transverse of the cabin structure. Wings are the semi-cantilever type. The main ribs and construction are conventional throughout.

CURTISS-WRIGHT MONOPLANES

A NEW line of the well known Curtiss-Wright monoplanes has recently been announced by the Curtiss-Wright



The British Hawker Fury



The Curtiss Wright Scout Air

Corporation. The machine is of the conventional body type, powered with a Wright-Whitcomb 200-hp. engine and designed to accommodate six persons. In this model performance has been improved by streamlining and fairing. A combination of the Towson type nacelles the engine and complete wheel fairings have been provided.

A new version of the well known Buffalo is now on the market. As in the case of the original design, the new machine is high-wing cabin monoplane of conventional appearance. It is offered for three power plants: (1) Curtiss-Wright Challenger, 355 hp.; (2) the Kestrel 210 hp., and (3) the Wright Whirlwind, 240 hp. Seats are provided for one passenger and two pilots.

APPROVED TYPE CERTIFICATES

DURING the period May 30 to June 13 the Aeronautics Branch of the Department of Commerce issued the following Group 1 approval type certificates: 412, American Puma 119 (Pawwitt 6-20, 120 hp.); 413, Lockheed, Green Model 9 (P & W Wasp 84 150 hp., 19-1 impeller, 2200 r.p.m.); 422, Curtiss-Wright, 1 (Curtiss-Wright 840 HP., 300 hp.); 423, Shannon S (Horsepower 8400, 215 hp.); 424, Sisco 137C (Continental A75, Series 2, 158 hp.); 425, Curtiss-Wright, Sedan 123 (Kinner C3, 210 hp.); 426, Curtiss-Wright Sedan 15C (Challenger, 185 hp.).



The four-place McCleary monoplane



The Hawker Fury biplane at the Detroit show, in the making

Aircraft at Work

Drug store chain operates an amphibian

THE Wilgreen Drug Stores company has used a Sikorsky S-55 amphibian extensively for aerial work in advertising and promotional work, and as a part of its personnel program. A feature of the latter has been the giving of a certain number of free rides in connection with the opening of a new branch. In Peoria, Ill., for instance, the company announced in a local paper the offer of 50 free rides to the holders of local company checks from coupons presented by persons visiting the store during the business hours of the opening day.

A two-week special publicity campaign was topped off with a so-called "Airlane sale" on Friday and Saturday of the last week. The company says, "During this publicity campaign we had an airplane window in each store in the city, showing pictures of drugs, including one ours. We allow the boys and girls under sixteen years of age to register for rides at any time during the two-week period. Adults may register only during the two days of the sale. Fifty of those registering were chosen by lottery on Friday in the plane." Not only city officials and other groups have been taken for special rides at various points.

The practical use of the plane is indicated from ride in amphibian as a reward for faithful and efficient service. Sales people in all Wilgreen branches

all over the country have been assembled through this plan the plane being flown from land and water ports according to local conditions. When it was visiting the New York area for instance, the plane operated from the North Beach seaplane base near a pier section not having been in operation at that time. It is used also for the transportation of executives.

Flying musicians travel by plane

THE Manned Aeronautics, an organization which has been active for more than a year, frequently travels out to meet engagements. Several musicians together own a Grumman T-37 Trainer for personal flying and publicity work for the orchestra, and considering the organization is presently on tour of a pilot's home or at least a weekend party. Of the eleven men now co-owning the brand two have limited commercial, four private and five student pilots.

In traveling by air, the orchestra sometimes uses subleased airplanes and at other times charters a trainer. The Trainer is used for by one member who has the largest commercial license and the others pay for solo time at the rate of about \$3 per hr. The machine has been used in drug clinics advertising the operation of the band at various points, and occasionally the leader commercial pilots carry passengers for a

few at places visited. The landing is decorated with the orchestra's name.

Pre-O-Lite's planes give valuable service

GO started was the Pre-O-Lite Storage Battery Corporation of Indianapolis with needs obtained with its first company-owned plane, that about five months ago it purchased an aircraft. The expense of the company is particularly interesting because based on approximately two years confirms one of aircraft in all parts of the country. The first plane, a Ryan Brumby, was flown for about 20 hours, during which time the machine was in the about 800 hr and several about 90,000 mi. About 200 cities were visited. When this report came to hand the company had had an Lockheed flight over one month, in that time the plane had been flown 40 hr and had covered about 5,000 mi.

Two of the most important points to be covered in operation of the company-owned plane are expense and ability to keep up schedule. Mr. J. H. Decker, vice-president of Pre-O-Lite, says that if the plane was required merely as a means of transportation, the company undoubtedly would object to its regular solo time over a small number. However, he says the many advantages of the plane for transportation and the additional advantages of contact which could not be secured in any other way more than balance the difference in cost of transportation.

Operating figures for the Ryan, the present May 18, 1969 to March 3, 1971, are available. The total direct operating expense was \$14,342.22, including the operating expense per hour \$21.83. These figures include the pilot's salary. The figure consumed 14,281 gal of gasoline, at the rate of 16.28 gal per hr, and 377 gal of oil at the rate of 44 gal per hr. Thus the plane was operated at an average cost of 6.05 mgal per gal of gasoline and 226.86 mgal per gal of oil. The total engine time was 852.12 hr.

Three observations about ground facilities for aircraft may be drawn from Pre-O-Lite's experience. One is that there are several parts of the country over which flying is extremely hazardous because of the insufficient number of airworthy landing fields.

Another is that airports as a rule are well maintained and, with very few exceptions, all sort of air contingencies have adequate ground facilities. A third is that a little closer attention should be given to land services between airports and the cities they serve. Distances coupled with inferior transportation

services create annoying and expensive inconveniences. According to Mr. McPherson, a very thin slice as airport has gone only half way if it does not provide greater transportation to and from it. Many cities in the country have adequately met the situation at the present time.

Technical Abstracts

LIFT DISTRIBUTION ON MONOPLANE WINGS

CALCULATION by TATIANA MOSKALOVA WING, by A. G. G. A. C. A. Technical Memorandum No. 570

THIS paper, a translation from *Sovetskoye Vozdushnoye Flotilo*, is a mathematical treatment of the distribution of lift on the wing of a monoplane. It is divided into two parts. (1) the calculation of optimum wing shape for a given lift distribution; and (2) the calculation of the lift distribution for a given wing.

A wing is characterized by its plan form or contour Γ (1), its profile, and its wing area S (2). The chord l and the chord x from the axis of symmetry, $b = 2x$, $l = 2x$ and $s = \text{angle of } \Gamma$.

It is first assumed that the relationship between lift coefficient and the angle of attack α is linear, thus being a reasonable assumption within the working range of a wing. The wing lift L is not fixed but depends on the wing area S for a given circulation distribution. Two cases can then be considered, the flat wing and the warped wing. For the flat wing the circulation distribution is fixed to be independent of the angle of attack, and L is a function of the ratio of the control chord to the span for a given circulation distribution.

To describe the application of the procedure an example is worked out, the circulation being determined for a flat wing with given span, control chord, and wing area. The circulation is determined for a wing of maximum thickness with the same span and area is given, and the induced drag, leading moments, and the moments of the two wings are compared.

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The Manned Aeronautics in uniform standing before a Cessna 441 on a grassy field.

work was devoted to determining the actual ratio of the maximum moment in the spine and its supports at the time of failure, as compared with the corresponding ratio while all the joints were still in the elastic limit. Over 300 beams were tested.

For a transversely loaded continuous beam of uniform cross section the proposed method of calculating the maximum load is very simple. The moments at the center support and the maximum load on the span should be calculated by the ordinary three moment equation. With the ratio of the latter to the former calculated, the ratio within the elastic limit, find the moment factor from the curve. This moment factor is the true ratio of moment at maximum load. Express the moment at the center support and the maximum moment in the span in terms of the load and reactions, multiply the moment factor and equate to the maximum moment in the span. Solve for the reaction in terms of the loads, and evaluate the maximum moment using these reactions. The maximum load can then be calculated by the usual formula, $M = \frac{W}{4}$.

If the beam is reinforced at the supports as is customary in airplane spars, first consider it to be of uniform cross-section throughout as beams, compute the relation of maximum moment in any span to that at the adjoining support having the greater moment, by the usual equation of three moments. Then take from the curve the moment factor corresponding to the relation thus computed. This moment factor tells to what fraction of its capacity the beam is in the span as stressed when the reinforced section at the support reaches the ultimate capacity. When the ratio and calculating the moments in terms of the loads and reactions in before, the maximum loads which the beam will carry can readily be calculated.

Application of the proposed method of calculation to continuous members subjected to combined axial and transverse loads is somewhat more difficult than for the beam with side load alone. The first step is to determine where the points of contraflexure will be when the maximum load is reached. If these points are known, consideration of the problem may be restricted to the portion of the beam between two successive points of contraflexure. Between a point of contraflexure and a fixed end, with a resulting simplification of the solution for each span. This solution will then involve merely the addition of a column under combined loading. However, when the section at the support is stressed to its maximum capacity, the section also as the portion of the span expanded between two points of contraflexure has its load carried by a certain fraction of its stress capacity, and hence it is necessary only to investigate conditions on its span.

As previously stated, the relation of moments for transverse load only is

influenced by means of the usual equation of three moments, with the assumption that the cross-section is uniform throughout. Moment factors are then taken from the curve, and considering one case at a time the problems of the points of contraflexure are located. The position as thus determined will not coincide exactly with their position at maximum load under combined loading, but calculations and tests have shown that the difference are so small that they can be neglected with safety. Knowing the points of contraflexure, the sections suspended between them at each span may be investigated. Under combined loading that section is fixed at a certain fraction of its stress capacity. For transverse load only the fraction is the moment factor less, but, with axial loads present, the fraction of stress capacity may be increased as follows:

Let K = moment factor, x = ratio of direct stress to total stress, U = maximum load modulus at the ratio x . Then the design modulus for the portion of the beam cut out in the span is $KU + x(U - KU)$.

The proposed method of calculating the ultimate strength of continuous beams is not only simpler than any other method yet suggested, but hands out data that have demonstrated that it gives accurate results. Maximum loads as obtained by this method for beams of rectangular section, and checked by tests, were, on the average, 25 per cent in excess of those calculated by the usual methods. For I beams the average increase was about 10 per cent. This discrepancy is too great to be neglected in good designs.

Airport Management



The waiting and boarding room at Westchester Airport.

Facilities for hop passengers

WESTCHESTER Airport Corporation, sponsor of the airport at this name at Armonk, N. Y., has installed a waiting and baggage room with two connecting vestibules. Passengers leaving a car at the company's chief offices and airport have been taken to various points and make their comfortable while waiting their turn to fly.

The waiting passenger does not have to stand in the open exposed to the elements or huddle from the parapet of a waiting place. He goes into the waiting room to buy his ticket or await the car, and while there he may be seated.

There are window chairs and direct facing the side windows on the airport side of the room, equivalent to rail, a map of the United States airways and map of Westchester County to inspect And while waiting he need not miss a thing going on at the airport, the windows offering an unobstructed view of all operations.

To handle specially large groups of waiting passengers—and they have them at Westchester on week-ends and holidays—a passageway, formed by two parallel walls 4 ft. apart and about 16 ft. long, has been provided back of the row of chairs and direct. The rails are of pipe and are raised about 4 ft. above the floor. Here the prospective riders may be kept in line for their turn, still

in full view of activities and protected from dust and unpleasantness.

The room itself measures 60x22 ft. and is on the port side of the administrative building. It is connected with the front office and baggage, and may be entered directly from the street or field by front doors. Where there have been installed for customer use.

Navy tries illuminated weather maps

An illuminated weather map has been installed at the Naval Air Station at Annapolis as an experiment in making



map providing weather conditions along most of the Atlantic seaboard as easy to understand and as up-to-the-minute as possible. Weather installations at New Dairs and Hampton Roads may be made.

The map itself is of black lines on a glowing glass panel about 10 ft. wide. Each weather reporting point is marked by the name and a large circle, below which (in the rear of the glass) are small circular bulbs of different colors. A circle in (thousands) by a white light when good flying conditions exist at that point. A green light indicates avoidable flying weather, and fog and severe winds by red. Two circles appearing in a circle indicate an expected change in conditions.

An important feature of the device is the ringing of a bell when a light is changed, giving immediate notice to all within hearing that a new condition has been reported. Sudden and violent conditions, such as squalls, thunder storms, are emphasized by the prolonged ringing of the bell. Weather information is quickly disseminated since there is one of these maps in the office of the commanding officer, one at the pilot's ready room and one in the meteorological office.

The map is supplemented by a panel of lights, facing to the right, which gives detailed information of conditions at each hour. Down the left side of this panel are names and lights showing local conditions. On the right side are the same conditions for each month's weather, such as low clouds, fog, visibility less than 3 mi., high winds, becoming worse, and so on. At the bottom of this panel are indicators the wind velocity and direction at 2,000 ft.

If the information on the map becomes two hours old, all the lights are extinguished. The watches are below the map in the meteorological office where the device was developed by Lt. J. B. Anderson, meteorological officer.

The Navy's illuminated weather map, shown mounted by Lt. Anderson, with details in development.

What Our Readers Say

In Defense of Leather

To our Editor:

Referring to Mr. Hardesty's article, "The leather December 12th," which appeared in the February, 1931, issue of AVIATION, I agree that it is time for the designer to give his attention to the wear that leather suffers. He should realize that money as material as steel are wasted unless they help his job as well as the customer's. A large number of people are dissatisfied with airplane construction on the apparent delivery of their construction. Materials which are light in weight, non-inflammable, available in many colors and patterns, and yet have the appearance of strength and safety are therefore to be desired.

Materials and in the manner. Genuine leather takes on a deep, rich natural color with age. The following table of comparative weights will be interesting:

Weight in ounces per sq. ft.	Weight in ounces per sq. ft.
Aluminum (2024-T3) 1.70 to 2.00	Aluminum (2024-T3) 1.70 to 2.00
Steel (AISI 1020) 4.90 to 5.10	Steel (AISI 1020) 4.90 to 5.10

Permit me to advance the thought that the big reason for the strength characteristics using materials other than leather is that they buy a small quantity and look to the nearest jobber to supply them with cut pieces from anything he has in stock. Any intelligent manufacturer who can allow his design on two weeks time to get material can secure genuine leather in two or three days less direct from the tannery.

J. E. MARGAN
The J. E. Margan Company
Chicago, Ill.

Servicing Short Cuts

SWINGING THE COMPASS

COMPENSATING compass on the Cessna two-engine plane of the Lusitania Lines at the Washington repair shop is greatly facilitated by the use of a special tail wheel cradle mounted on the rear of a small automobile truck. The apparatus is built up of steel tubing and channels welded in-

of the plane. A pulley is set up on the rear section of the wing and the North South line established. By drawing the truck around in a circle about the main landing wheels as a center, the airplane may be readily swung through the 360 deg. necessary to calibrate the compass. Two men are required for the operation—one to swing the pulley, and one to drive the truck. The latter enters the cockpit after each setting of the airplane, and makes the required entries on the compass correction card.

revision must be made between the point where the line leaves the fuselage structure and the point where it is attached to the engine. Two types which have given very good results in service are shown in the accompanying illustration. The arrangement in the upper part of the cut shows a connection suitable for taking 3 in. in diameter or larger, and the lower one shows the joint designed for 2 in. line. Details of the two assem-



Flexible connections for engine tubing

bls are clearly shown. After a short time in service the rubber hose under the clamp adheres very tightly to the tubing, and in order to avoid disturbing the joint when it is necessary for lines to be disassembled, a standard ground joint mass is inserted adjacent to the flexible joint.

PROTECTING ENGINE CYLINDERS

A COMBINATION of rust-inhibiting and flying mud encountered at the T. C. Ryan Airport at San Diego, Cal., makes it difficult to protect exposed engine parts against corrosion and abrasion by the use of ordinary cylinder paint or enamel. After considerable experimental work it was found that a special Portland cement joint, known as L & S Portland Cement No. 323, manufactured by the General Portland Cement Corp. gave good results. When applied to cylinders it produces a rough, black surface which adheres well to the metal, and resists the flaking action of flying mud and the scourage of salt air.

The paint requires several days to dry properly, however, during which time cylinders and other parts must be thoroughly protected. Satisfactory results have been obtained by first removing and sanding the valve mechanism of each cylinder and covering all exposed parts with tape. The paint is then applied by means of a spray gun and the cylinder set aside in a protected location to dry. When thoroughly dry, the spring is removed from the valve gear and the cylinders are ready for immediate assembly to the crankcase.

A WOOD STEAMER FOR THE SMALL SHOP

A UNIQUE wood steamer has been developed for use in the wood working shop of the Boeing School of Aeronautics at Oakland, Cal. Although the amount of wood steamed is too small to justify installation of a large unit, some steaming must be done. As it is length of four feet was selected to a gas-heating radiator which is part of the shop heating equipment. Steam from the radiator is lead directly into the pipe. A small valve regulates the admission of steam, and a gage shows the pressure in the chamber. One end of the casing is closed with a permanent cap and the other fitted with one which can be readily removed by means of handles bolted to it. Strips of wood up to 8 ft. long and 1 in. wide can be accommodated.

FLEXIBLE JOINTS IN FUEL LINES

TO prevent fatigue failure in lines used to supply fuel and oil to an aircraft engine some sort of flexible con-



Close up of tailwheel cradle and wheel cradle

nection, and held down on the truck platform by four bolts. With the tail wheel resting in the cradle the airplane is supported in flying position. A clamping band on the cradle holds the wheel firmly in place and makes it possible to tow the plane with the truck without danger of the wheel slipping out of its cradle.

In adjusting compass a level spot on the field or screen to which certain known directional reference marks are visible. The truck supporting the tail wheel is adjusted so that the axis is at 90 deg. to the thrust-line.



Boiler and wood steamer

Design Novelties

Tail wheel assembly

TO avoid the expense of conventional tail wheel replacement and the danger and delay which a cold causes in landing on a dry field, Mr. J. H. Stambauer, assistant manager of operations at the Washburn-Stamper Airport, designed a simple tail wheel assembly which may be substituted for the old unit without any change in the structure of the aircraft surface. The experiment was installed originally on a New Standard (2-2) four-passenger airplane used for nightseeing trips over the city of Washington, but is also available for other types.

A 30-lb. tire mounted on an aluminum alloy hub is carried in a steel fork made up of welded steel tubing. The shock of the fork slides into a steel tube sleeve which contains a series of rubber compression discs so arranged that landing shocks are absorbed by the rubber. The outer sleeve is fastened to the fuselage by means of visible welded-on steel brackets. The top of the wheel has externally reduced the 3000 x 1.9 mm. repair ball which was changed around the sled in the course of a year's operation.

Rigid type landing gear

THE Waco Aircraft Company of Troy, Ohio, recently exhibited a machine equipped with a landing gear



The Waco rigid landing gear



Tail wheel assembly installed on a New Standard biplane

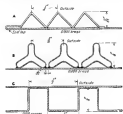
which differs from the ordinary in that all main structural members are rigidly attached to the fuselage, and shock is absorbed by telescoping a rigid shock

into one of the fixed struts. The motion of the shock and wheel is controlled by an Allen gear mounted inside the stationary strut over the point of attachment to the fuselage. The shock is forced down and up by a steel cable welded to the lower end and

extending forward into the lower fuselage. Such members are enclosed in a covering during Transverse, both halves of the undercarriage are braced by a single piece of cross bracing members. A flexible joint (skewed back in the illustration to show the details of the wheel construction) prevents the moving parts from fret, means greater and all, and is relatively smooth covering when the machine is in the air with wheels in the full down position.

Wing type radiators

ELSEWHERE in this issue reference is made to the results obtained from the use of wing radiators on racing airplanes. The accompanying series of four views from Mr. G. A. Lohrer's paper "Wing Radiator Development" read at the Baltimore Meeting at the A.S.M.E. recently, illustrate three typical methods of construction for such



Typical wing radiator sections: A, recessed (internal); B, external (external); C, semi-external (external); D, external (external) with variable wing radiator installation

Airplane and type	Army Race RUE (2)	Army Race RUE (3)	Supersonic RUE (3)
Boeing Stearman	144	215	204
Boeing Stearman	400	170	875
Boeing Stearman	234	120	495
Boeing Stearman	221	122	495
Total weight with wing (lb.)	140	180	400
Weight per sq. ft. (lb.)	100	1.100	1.100
Weight per sq. ft. (lb.)	100	1.100	1.100
Weight per sq. ft. (lb.)	100	1.100	1.100

are the flumes of the stored liquid into water, the maintenance of full storage made by the introduction of additional water as withdrawals are made, and the discharge of the stored liquid from the top of the static rubber sheet from the bottom as is the case with the usual storage systems.—*AVIATION*, July, 1932

Coupage corrector

A new instrument designed to aid the navigator of water or aircraft has been constructed by the Boston Yacht Sales, Inc., 120 State St., Boston, Mass. The instrument is known as the *Adams Variator-Deviation Corrector* and is used to correct compass errors. It consists of a movable arm and a movable colored disc mounted on a second and larger disc. Manipulation of the arm and disc in accordance with instructions which appear on the back yield the necessary correction for compensating for small compass errors.—*AVIATION*, July, 1934.

Catalogs

Parker-Kelco Corporation Self-lapping sheet metal covers are being sent to the aircraft industry for fastening control parts, exhausters, levers, etc. The *Parker-Kelco Corporation*, at 300 Park St., New York, N. Y., manufacturers, have issued a bulletin describing applications of their products, including test results showing the strength of such fastenings in tension and shear.

The *International Model Company* Specifications and data on the small light aircraft used in the *Army-Navy* aircraft engine, motor, with a description of each engine, its parts, and its accessories, are covered in a new bulletin issued by the *International Model Company* of 69 Wall St., New York City. Copies of this bulletin may be obtained on request.

The *R. G. Corporation*, a booklet has been received from the *R. G. Corporation* of 136 West 34th St., New York, describing the new *R. G. radio shielded pack plug*. The construction of the plug and connection for various shielding systems are illustrated by photographs and line drawings.

Pittsburgh Electric & Manufacturing Company Information concerning applications of small speed power driven generators suitable for supplying electric current for lighting or other purposes in isolated locations is included in Bulletin No. 4-4000, issued by the *Pittsburgh Electric & Manufacturing Company* of East Pittsburgh, Pa. The title is "Westinghouse Small Generator Units and Their Applications."

Side Slips

By ROBERT H. OSBORN

DURING the annual race of representative of the industry to Langley Field laboratories of the N.A.A.C.A., the new full scale wind tunnel was finally put into operation. This tunnel has a testing throat 50x20 ft. and now develops wind speeds up to 115 mph. Mr. C. W. H. of Langley made the excellent suggestion that it would be an ideal place for the Department of Commerce to place out some of the new "lefts flights"—with plenty of instructions on the floor.

We hadn't really realized that the industry was in a bad way until we made this trip to Langley Field with some of the leading manufacturers. All of them had bright and smiling faces, were smoking ten cent cigars after tea and eggs, and were full of cheerful prophecies for the future. When they have that outlook, you know, if some day haven't an order in the plant and don't know where the next week's payroll is coming from. Don't ask us to explain why, but the species have spent airplane manufacturers look most disheartened when he is most prosperous.

This Macdonald's interview was held in the *Bullfinch Evening Review* for a while in Col. Thomas C. Turner, on a recent visit to the Buffalo airport. The article states: "He spoke lightly of the flying area and facilities. He will leave as soon as the weather clears."

Miss H.L., our former dance Macdonald correspondent, but now of Los Angeles, Cal., wrote us a clipping from a contemporary magazine with the comment: "Here is news of a new type you may wish to look into. If practicable they should be a ready sale for the drought-stricken sections of the country." The clipping states that Lawrence D. Bell, general manager, Consolidated American Corporation, Buffalo, N. Y., is in Mexico City to demonstrate a sailing ship to the Mexican Air Corps.

Mr. C.B.A. of the New York World-Telegram, notes that the production of mystery planes is being up to schedule. From your information sent out by the Aeronautical Chamber of Commerce during the recent maneuvers. Listing the planes engaged in the maneuvers they have under "Thunder"—75 Curtiss Hawk Bombardiers."

Mr. T.G. of New York discovers an engine described in an engineering

publication which "develops 25 hp at 25 rpm" and writes in so "kind out of a reasonable push prop might use visible the size of the engine is good evidence in a high wind." He also adds at the end of his note "I think I am now entitled to my laurels as local aviation editor. Please forward in tonight please. You can start the electric plane that goes with it. I have one."

Mr. T.G. has counted one detail of engineering this morning, which is to contribute ten dollars to the "Fund for the Bicentennial of All Nations at Fiftieth Years of Age," of which kind we are the shareholders.

This letter, C. F. McRae who keeps as much on things associated on the Pacific coast basis into the office with another batch of mail. In his first case he probably points out that a practical one has at last been found for the needs of the California boys who change propellers, overhaul engines, and replace landing wheels in flight. They say, he, remove the propellers which are now changing up our aircraft after they reach 200 mph. This suggestion is supported by the following Associated Press dispatch printed in a California paper:

One of America's fastest airplanes, transport design that engine at 200 miles an hour, will be replaced when one of the simplest pieces of mechanism—the propeller—has been developed. Captain C. F. McRae, of the California Air Corps, believes. And the time, he adds, is not far off. The present speed has been reached by streamlining and the development of powerful motors. "Right now we can go no further. We have built a ship so streamlined that at a speed of slightly more than 200 miles an hour the air force actually catches up with the motor and causes through the air. The motor is pulling at tremendous speed but it cannot get away from the ship and pull it faster."

Mr. D.E. of Glasgow, Mont., discovered the following in the *Great Falls (Mont.) Tribune*:

The airplane has such wings and four long wings like the airplane that it is pulled through the air by a conventional propeller."

The engineers has changed a bit since we saw this, and we hereby warn Mr. Fritson that if he ever puts an electric plane in one we're going to start a quality campaign to have the last Golden Vindicator sword reconsidered.



—and still going strong Another Timken Bearing Service Record!

The Timken Roller Bearings in this Elliott pump installed in a large industrial plant have been in actual service over 4 years, averaging 20 hours a day, 6 days a week, with no attention except for lubrication.

During this time they have rolled up the staggering total of 6 billion revolutions at 3500 a minute—175 times the life of the average automobile—and a recent inspection showed them to be in perfect condition and good for billions more.

THE TIMKEN ROLLER BEARING COMPANY, LTD., TORONTO, ONTARIO

TIMKEN Tapered Roller BEARINGS

A NEW WORLD'S RECORD WITH TEXACO



TELEGRAM

ON OUR LAST FLIGHT, IN WHICH WE FINALLY MADE A NEW WORLD'S NON-REFUELING ENDURANCE RECORD, AS ON PREVIOUS FLIGHTS OUR PACKAGED BELLER ENGINE INSTALLED IN THE BELMONT PLANE HAS PERFECTLY BEEN START TO FIGHT ON TEXACO AIRCRAFT FUEL, TEXACO AIR PLANE OIL AND TEXACO AIRPLANE GREASE'S 3000X AND 4000X. WHAT MORE COULD ANYONE ASK US WANT TO THANK THE TEXACO COMPANY FOR THE EXCELLENT COOPERATION WE RECEIVED THROUGHOUT ALL OF OUR THREE ATTEMPTS—

WALTER LEEB AND FREDERICK HOSBY

THE Packard Diesel Aircraft Engine breaks the world's record in a non-refueling endurance test! A Bellanca plane powered by the Packard Diesel Aircraft Engine and flown by chief test-pilot Walter Lee and pilot Frederick Hosby remained in the air 84 hours and 33 minutes!

The plane took off from Jacksonville Beach, Florida at 6:47 A. M. May 25th and landed at 7:00 P. M., May 28th. Texaco Aerodiesel Fuel, Texaco Airplane Oil No. 5 and Texaco Marfak Grease No. 3 fueled and lubricated the plane throughout the flight.

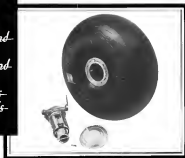
It was a remarkable demonstration of the power and endurance of this new type of engine, and of the exceptionally high quality of the fuel and lubricants that kept it functioning perfectly every minute of those long, trying hours in the air.

Both pilots were highly pleased with the performance of the Texaco Products they selected for this spectacular test. Read the telegram. These same Texaco Aviation Products are distributed at principal airports in every State.

THE TEXAS COMPANY
135 East 42nd Street New York City

Texaco Aviation Products include Texaco Aero Diesel Fuel, Texaco Aviation Gasoline, Texaco Airplane Oil, Texaco Marfak Grease and Texaco Argol's products for many uses on the air.

*Mud
Sand
Snow
Plowed Ground
Timber
Rolling Ground
Fog
Cross Winds
Small Fields
Water*



Here's what we mean by "AIRWHEEL SAFETY"

Let your eye run down that list of landing hazards which threaten every pilot and plane before Goodyear developed Airwheels.

Then notice how few hazards are left on the list today.

Seven out of ten are banished by these big soft rolling rubber pillows—Goodyear Airwheels and the new Airwheel roller bearing brake.

Good luck and a good pilot may bring a ship through such landings without Airwheels—but the odds are three times as good if you

have this Goodyear equipment.

Goodyear builds Airwheels to operate at inflation so low that you can roll the plane safely through mud, over sand, or across plowed ground without seeing over. And most pilots now know that this great wheel-and-roller combined called an Airwheel makes even wind or downcast landings a cinch.

Power, smoothness and sure release are combined in the new Airwheel brakes—the brakes developed exclusively for aviation. With these brakes you can slide

the wheels or bring up the tail (depending on landing surface) and still keep complete control. You can hold the ship at full throttle—let it roll and stop it again! How's that for power?

Only Goodyear can give you Airwheel safety. And now you can get it for no more than you pay for ordinary tire and wheel equipment. Can you afford to fly without it? For engineering details, write or wire Aeronautics Department, Goodyear, Akron, Ohio, or Los Angeles, California.

When you buy a new ship specify Goodyear Airwheels

GOODYEAR

EVERYTHING IN RUBBER FOR THE AIRPLANE

THE NEW PIONEER DRIFT INDICATOR SIMPLE-COMPACT-INEXPENSIVE

IT IS as important to know the angle of drift as it is to know the compass heading of your objective.

To enable the pilot or navigator to ascertain drift as simply as possible the new Pioneer Drift Indicator, type 623, has been developed.

This Drift Indicator is one of the four new Pioneer Instruments that attracted so much attention at the National Air Show. It is compact, light in weight, and simply constructed. The principal parts are a coiled ground glass screen provided with parallel night wires, and a lens inserted in the bottom of a funnel-shaped case.

Ground Observations Made

Easily and Quickly

To make an observation the screen is rotated until objects below appear to travel in a line parallel to the sight wires. Then the angle of drift may be read directly from the graduated scale. Whether it is added to or subtracted from the compass reading is plainly indicated.

In night flying, lighted objects show up on the screen with remarkable clearness. Pilot or navigator may thus make drift observations as readily at night as in the daytime, if ground lights of any nature are visible.

In order to get the most benefit from your compass you should supplement it with a Pioneer Drift Meter. This new instrument is so inexpensive you can hardly afford to be without it. Write for information and prices.

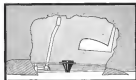


The use of a Pioneer Drift Indicator with a Pioneer Drift Meter makes an ideal combination.

The above illustration is a top view of the Pioneer Indicator showing the sight wires and graduated scale.

A compass operated model is also available. It is known as type 642 and is rotated by means of a flexible shaft which is connected to a small crank unit mounted on the instrument board.

Type 623 Drift Indicator is mounted in the front of the plane as shown below.



PIONEER INSTRUMENT COMPANY

INCORPORATED • DIVISION OF BENDER AVIATION CORPORATION
734 LEXINGTON AVENUE • BROOKLYN NEW YORK

SOLE INTERNATIONAL SALES AGENTS: ROBERTS ENGINEERING CO., 1000 BROADWAY, NEW YORK 10
SOLE U.S. SALES AGENTS: ROBERTS ENGINEERING CO., 1000 BROADWAY, NEW YORK 10
SOLE U.S. SALES AGENTS: ROBERTS ENGINEERING CO., 1000 BROADWAY, NEW YORK 10

FORD EXPRESS!

THE time has come for freight to fly! Transportation of passengers by air is already an established factor in business. So also is air transportation of mail.

The new Ford plane, designed primarily for freight, mail and express, first appeared at the National Aircraft Show in Detroit.

The wings and fuselage of the Ford Express conform to the specifications of the famous Model 5AT Ford transport. Its greatest distinguishing feature is that it is equipped with only one motor... a Hispano-Suiza 715-H.P. (American rating at 2000 r.p.m.) water-cooled engine.

PERFORMANCE SPECIFICATIONS ARE:
Pay load, 3500 pounds.

Useful load, 4900 pounds.

Weight of plane, 6100 pounds.

Gross weight carried by plane, 11,000 pounds.

High speed... 135 m.p.h.

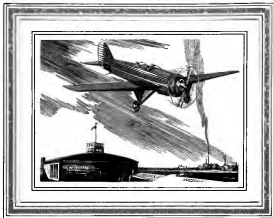
Cruising speed... 110 m.p.h.

Ceiling... 15,000 feet.

Rate of climb... 700 feet.

The Ford Express plane is specially valuable as a carrier where swift freight and express are at a premium.

• FORD MOTOR COMPANY •



Here's one place where
ordinary oil won't do
use **PENNZOIL**
costs less per flying hour

Ask for **PENNZOIL**—
Not just "Pennsylvania Oil"



PENNZOIL is made by the Standard
Process Process from 100% pure
Pennsylvania crude and nothing else.

MADE IN U.S.A.
REGISTERED TRADE MARK

Good lubrication is one of the essentials of motor maintenance. Nearly any of the big air lines can tell you that. That's why they use Pennzoil Aircraft Oils. They're designed to get the last notch of speed out of your plane and keep it properly lubricated.

Pennzoil is economical. It increases the period between overhauls. It gives you thirty to forty hours to the filling. It costs less per flying hour. With Pennzoil, dependability and economy go hand in hand.

The PENNZOIL COMPANY: Executive Offices and Refinery: Oil City, Pa.
Distribution Offices: New York, Chicago, Los Angeles
Branches: Alameda, Cal., Salt Lake, Tulsa, Minneapolis, St. Louis, and Spokane, Seattle

AIR TRANSPORTATION ★ DEMANDS ★ GREATER SPEED

SPEED IS PROGRESS. For that reason the horse replaced the ox; the railroad and automobile the horse, and five-day boats drove white sails from the seven seas. ★ Speed is the only reason for aviation. The transport operator must realize this. He must provide the speediest of all transportation. If he does not the world will go back to trains and motor cars.

Speed is the reason for the rugged construction—the streamline design—the ample power (515 h.p.) of the Model 17 FLEETSTER... and its cruising range of 750 miles at 155 miles an hour. ★ The Model 17 FLEETSTER was planned to meet the demands of the air traveler for speed and comfort. With ample baggage space, this eight-place, convertible landplane or seaplane will make money where a less speedy, reliable or popular plane, though larger, would carry a partial load at a loss. Speeds of the stability, safety, economy and performance of the Model 17 FLEETSTER for transport service or private ownership will be soon on request to anyone interested in economical air transportation.

MODEL 17... A.T.C. 369



THE FLEETSTER



MODEL 20... A.T.C. 320

AIR TRANSPORTERS' demands for speed are incessant—but those of the air-mail and express service are imperative... Business is won—or lost—through success or failure in maintaining rigid schedules. ★ High speed and suitable cargo capacity alone can make air transportation profitable—and popular. The Model 20 FLEETSTER is amply powered for its cruising range of 700 miles at 145 miles an hour. ★ It arrives on time. Every cubic foot of its payload capacity serves a useful purpose. The pilot's rear cockpit permits the most efficient adaptation and arrangement of its useful load (2461 lbs.) to individual requirements for passenger, mail and express accommodations. ★ The Model 20 FLEETSTER is more economical in operation and maintenance than any similar plane of its type. Every factor of its appeal to progressive transport operators is worthy of consideration by corporation executives whose widespread activities demand speed in the transportation of cargoes or personnel. Write for facts regarding the Model 20 FLEETSTER for all transport purposes.

**CONSOLIDATED
★ AIRCRAFT ★
CORPORATION
BUFFALO, N. Y.**



BUILDING CHANCE VOUGHT STAMINA INTO AIRPLANES

Metal parts on Chance Vought airplanes hold their finish. No landings in rough salt water—no dives through soaking clouds of rain—no penetrating fogs break through to start corrosion. Perched high on the exposed decks of Navy ships at sea, Vought planes are well protected against the lash of wind-blown spray.

Before the three protective coats of red oxide and enamel go on, the metal parts are cleaned and surfaced in the sandblasting room. Clouds of fine, sharp grains with a

lusty pressure of air behind them remove every vestige of dirt and grease, producing a surface to which the finish hangs on through the toughest kind of service.

In the modern, snail-like Vought plant at East Hartford, you'll find the latest equipment and processes. And you will discover many ingenious methods and mechanisms which are as characteristically Vought as the ships themselves. Chance Vought Corporation, East Hartford, Connecticut. Division of United Aircraft & Transport Corporation.



**CHANCE VOUGHT
CORPORATION**



ECONOMICAL CRUISING

MAXIMUM economy at part throttle or cruising speed has taken on a new meaning with the development of the Stromberg Aircraft Carburetor.

Two types of *Economizer Systems* contribute to this efficiency on Strombergs.

One is the *Needle Valve* type, the other, the *Piston* type. Both are operated by the throttle; both permit the carburetor to operate at maximum efficiency on a lean mixture at cruising speed and provide a rich, powerful mixture at full throttle.

Economical cruising is one of many reasons why Stromberg carburetors are used on over 95% of the aircraft engines now being built in the United States. Stromberg engineers will gladly help you with your own carburetion problems. Inquiries are invited.

STROMBERG CARBURETORS

BENDIX STROMBERG CARBURETOR COMPANY

† SUBSIDIARY OF BENDIX AVIATION CORPORATION †
701 BENDIX DRIVE - SOUTH BEND, INDIANA

The 1931 GREAT LAKES Sport Trainer

\$2985 Flyaway, Factory



CASH IN NOW ON THIS NEW INTEREST IN AVIATION!

With the coming of the 1931 Great Lakes Sport Trainer, there has been a sharp reawakening of interest by those who would take to the air in a practical way.

The greater beauty and stability of this staunch and dependable plane—always a popular choice for initial flight instruction—has aroused renewed interest from all parts of the country.

At the new price of \$2985, the Sport Trainer is exactly the ship for those keen-minded followers of aviation who have been waiting for just such a popularly priced, dependable plane to get into the air at once.

This is the time when the complete details of the Great Lakes Sport Trainer should be in your hands. Write for them today.

DEALERS—the Great Lakes proposition contains so many merchandising advantages that you ought to have all the details at once. Write or wire immediately.

GREAT LAKES AIRCRAFT
CORPORATION CLEVELAND
Contractors to the United States Army and Navy



Photograph by J. J. Bennett & Associates

Cut the Gun!—no flooding with Socony

800 feet up . . . cut the gun . . . get ready to set 'er down. Just as Socony Aviation Gasoline has powered your plane in flight, so you'll find no excess flooding at the carburetor when you cut the gun.

And if you should want to give 'er the gun again suddenly, she'll start climbing without a spatter. You can do that sort of thing easily when your plane is fueled with Socony Aviation Gasoline and lubricated with the New Socony Motor Oil.

SOCONY
AVIATION GASOLINE

NEW
SOCONY MOTOR OIL

SOCONY

STANDARD OIL COMPANY OF NEW YORK

1 MAN INSTEAD OF 4

AND A FASTER FUELING JOB



G & B AEROPORT
at Hunter Field
Washington, D. C.

WE SENT A PLANE
16,000 MILES TO
PROVE THE NEED FOR
OUR FILTER FUNNEL.



In the past, operators have been required to risk a dropped cartridge or fuel line while they spent five to ten minutes on a slow, clumsy, and awkward filtering job. That's why we built our Filter Funnel. That's why we sent our plane all over the country to prove its amazing efficiency. Our portable filter has shown a 100% water resistance to 50 gallons per minute delivery. The Filter Funnel also takes out all acid impurities. Costs just 10¢ and will pay for itself with savings on motor overhauls. Operators and airports should stock this special time saver.

The G&B Aeroport makes fueling a matter of simple routine. One man does the job—not a crowd. No mobile equipment clogs up your field. Your Aeroport is always on the filling line. Ships don't wait for service either.

Convenient! Long on wear! Economical in operation!—And you get in addition an exceptionally fast service. Recently a big transport plane was

served 332 gallons of fuel in 9 minutes. Thanks to its "ground level" safety, the Aeroport lessens field hazards. When open, the covers can't touch the wings of a plane. That's nothing to knock over. Fire hazards are reduced.

No wonder you find Aeroports at airports all over the nation, here and abroad! Costs you nothing to get complete information.



- | | |
|--|--|
| A. Portable unit shown in list | B. Fuel chamber opens to rear of tank |
| C. Fuel chamber can swing out and fold | D. Fuel chamber can swing out and fold |
| E. Fuel chamber can swing out and fold | F. Fuel chamber can swing out and fold |
| G. Fuel chamber can swing out and fold | H. Fuel chamber can swing out and fold |

GILBERT AND BARKER
MANUFACTURING
SPRINGFIELD
MASS., U.S.A.
G & B
MADE IN U.S.A.

STANDARD THE



WORLD OVER

VALVE FACE GRINDING MACHINE

Precision Work on Valve Refacing

and other valve jobs, is done easier and quicker on the Sioux Valve Face Grinding Machine. It is so accurate, dependable and sturdy because it has these exclusive Sioux features—

1. **Sioux Roller Chucking System** grips valve stems firmly above worn surface and holds it perfectly centered. Self-aligning, adjustable, positive, accurate.
2. **Automatic Lubrication**—through oil-liking felt wicks. Keeps out grit and dirt.
3. **Smooth, positive operation**, with fewer parts, through use of SKF self-aligning ball bearings.
4. **Simple, positive, fail-proof method** of engaging and disengaging drive shaft by means of a cam shaft.

Only in the "Sioux" can you get these features and the lowest Sioux guarantee. Investigate before you buy.



No. 660 for gasoline valves of any make. Handles valve stems of 5/16 in. to 13/16 in. diameter. Complete with 1/4 H.P.A.C. motor, extra grinding wheel for large, hard valves, wrenches, etc.
Net \$187.50

Your Jobber Sells Them

ALBERTSON & CO. INC.
SIOUX CITY, IOWA, U.S.A.

FAIR LEAD BUSHINGS *that don't Swell or Shrink*

FORMICA sheets and tubes are made up into fairlead bushings that retain their dimensions under the greatest variety of weather. The material wears as well as cast iron but will not corrode or rot or change in any way that will cause the cables to bind.

Formica cabin lining in wood finishes, solid colors and art moderne finishes is light, extremely durable. It is not injured by moisture or liquids, will not crack or check with age. Some extremely handsome cabs have been built with this material as side walls in the cabin.

FORMICA CONTROL PULLEYS

These pulleys are made in three types: with bronze bearings incorporated with pulleys, ball bearings and roller bearings. These pulleys will operate efficiently in any temperature climate. They have been extremely popular and are used on a large percentage of the planes now produced.



FORMICA

THE FORMICA INSULATION COMPANY

4018 Spring Grove Avenue
Cincinnati, Ohio

MORE AIR HOURS

Gulfpride Oil's low-pollution control of carbon of the engine chamber is the key to the longer life of the engine. Gulfpride Oil's low-pollution control of carbon of the engine chamber is the key to the longer life of the engine.

Gulfpride Oil's low-pollution control of carbon of the engine chamber is the key to the longer life of the engine. Gulfpride Oil's low-pollution control of carbon of the engine chamber is the key to the longer life of the engine.

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**Gulfpride
Oil**

...There's good reason why THIS OIL HOLDS ITS BODY

It's a big mistake to think that "all oils are about alike." Read quick facts here and see why

It's a fact that Gulfpride Oil's slow combustion rate is the key to its long life. That is, they hold their body well under extreme high temperature operating conditions, yet do not become excessively stiff and sticky at low starting temperatures.

Gulfpride Oil's slow combustion rate is the key to its long life. That is, they hold their body well under extreme high temperature operating conditions, yet do not become excessively stiff and sticky at low starting temperatures.

Gulfpride Oil's slow combustion rate is the key to its long life. That is, they hold their body well under extreme high temperature operating conditions, yet do not become excessively stiff and sticky at low starting temperatures.

Add up these advantages... resistance to heat, fast recovery from starting, low smoke and low carbon formation... and you see why Gulfpride Oil gives you more air hours. Ask for it in the field.

FREE... a booklet of 100 pages, 1000 illustrations, and slow combustion with the slow combustion rate. Gulfpride Oil's slow combustion rate is the key to its long life. That is, they hold their body well under extreme high temperature operating conditions, yet do not become excessively stiff and sticky at low starting temperatures.



• GULF REFINING COMPANY •

Hahn Plugs take the IGNITION RACKET out of Radio

IGNITION RACKET and bad weather make a dangerous combination. When fog blankets the route, or storms are brewing ahead, faultless radio reception becomes a safety necessity.

Hahn Spark Plugs, installed in conjunction with shielded harness and shielded magnetos, eliminate all interference from the ignition system. By silencing Ignition Racket, they make it possible for the pilot to pick up weather broadcasts or beacon signals more easily and at longer range.

At the same time, Hahn Plugs give engine performance that cannot be excelled even with the best unshielded plugs. Hahn Plugs average 500 flying hours in service... some have been used for over 800 hours. Considered from the standpoint of cost per hour of flight, they are the lowest in price.

Hahn Plugs are insulated with mica. They are water and spray proof. They do not foul and will not preignite. They can be used with any make of harness.

Our engineers are specialists in radio shielding. They have developed complete shielding installations for the ignition system that are surprisingly low in cost. Why not let them help you with your radio shielding problems?



HAHN RADIO SHIELDED SPARK PLUG

Walter Kidde & Company, Inc.
140 Cedar Street
New York

Investigate the LUX Extinguisher for Aircraft Protection

Engine fires hold no terrors for those who fly on Lux protected planes. At the first sign of fire, one quick pull on the Lux manual handle releases the Lux extinguisher and envelops the entire engine in a harmless cloud of fire-smothering carbon dioxide gas. All fires are extinguished instantly.

Over 300 planes are Lux protected. Among them are planes built by Ford, Packard, Stinson, Poinsett, Great Lakes, Keystone and Stearman. Write for details.



Look to BENDIX for Airplane Wheels and Brakes

Bendix engineering developed and perfected the wheel-and-brake for aircraft—which has contributed so vitally to efficiency in ground maneuvers and to safety.

Bendix now offers the new roller-bearing wheel and brake for still further increased efficiency.

Bendix also offers the Bendix low-pressure wheel, equipped with roller bearings.

All Bendix' broad experience in brakes—automobile and aviation—is built into these new units.

Built to U. S. Army Air Corps, U. S. Navy, S. A. E., and Tire and Rim Association Standards.

BENDIX BRAKE COMPANY
SOUTH BEND, INDIANA
(Subsidiary of Bendix Aviation Corporation)

BENDIX 4 BRAKES

FOR SAFETY

FULLY PROTECTED BY PATENTS AND APPLICATIONS IN U. S. AND ABROAD

See Mail Box One

To the ARMY AIR CORPS Congratulations

From the furrows of their fields men looked aloft in wonder; in country road and city street, on the roofs of towering skyscrapers, millions watched with soaring pride as your great armada of the air swept by on thundering wings.

With equal pride and full realization of your accomplishment, we whose lives are devoted to aviation take this opportunity of offering our congratulations on the success of the 1931 Army Air Corps Exercises.

The executive, administrative and flying personnel and the ground organization showed a peak of efficiency, and the equipment a mechanical perfection, that mark significant progress since the World War.

With congress and the people of this country we rejoice in this fitting climax to the five-year army program of the aviation branch of our national defense.

FOKKER AIRCRAFT CORPORATION OF AMERICA

Division of General Aviation Corporation

GENERAL MOTORS BUILDING, NEW YORK

**"Opened instantly from 75 ft. altitude
— wonderful Safety demonstration"**



Writes
Woodruff De Silva
*Assistant
Director of Airports
Los Angeles
Calif.*

*Actual Photograph
by
ACME—P & E*

SWITLIK SAFETY CHUTES

The above excerpt is from one of many letters we have received from prominent Aviation Officials, praising the Remarkable Performance of the SWITLIK SAFETY CHUTE. This parachute is the lightest, most compact and efficient parachute in the world today. It functions under all conditions due to its self-aid engineering. The snag-free harness is a revelation to wear, made of soft pure pigged linen and held in a vast shape by the patented back pad and harness combination. SWITLIK is standard equipment for the foremost sporting lines and flying schools everywhere.

White Silk
\$300
Parapet Silk
\$240

SWITLIK PARACHUTE & EQUIPMENT Co.
BROAD & DYE STREETS TRENTON, N. J.

WESTERN MANAGER — BERT WHITE — 1333 AIRWAY — GRAND CENTRAL AIR TERMINAL — GLENDALE, CALIF.

THE AUTOMOTIVE INDUSTRY MUST KNOW THE CHEAPEST WAY TO ASSEMBLE SECURELY



Self-tapping Screws are used on 85% of the industry's production

Millions of fastenings are made in a year's production of a car or body. The manufacturer cannot afford to risk fastening devices in a haphazard manner. He must know to the fraction of a cent which fastening device is the most economical to use . . . which one offers the surest and quickest way of making metal assemblies.

It is significant that Self-tapping Screws are used for metal assembly on 85 per cent of the automotive industry's production. The industry's saving through the use of these unique Screws is enormous. One body builder alone saved over \$150,000 in a single year by using Self-tapping Screws in place of machine screws and other devices for

making fastenings to sheet metal. He gained more secure assemblies, too. For scientific tests show that fastenings made with Self-tapping Screws hold better than either machine screws or bolts cut into under tension, shear and vibration stresses.

Whether you make automobile bodies or car poppers . . . if your product requires metal assembly you may be able to do it cheaper and better with Self-tapping Screws. It can't nothing to find out. Our Assembly Engineers will tell you, if you attach a description of your assemblies to the coupon which brings two free booklets on Economy and Security of making fastenings with Self-tapping Screws.



Hardenad Self-tapping Sheet Metal Screws

For piercing and making fastenings to sheet metal use in all grades of thickness. No cutting. Available in all diameters. Screws are self-drilling, pierced as machine holes in sheet and in the material to be drilled or tapped. No need for pre-drilled holes.

Type "B"—Hardenad Machine Screws

This type of Self-tapping Screw is used for making permanent fastenings to steel, brass and aluminum castings, sheet, tubing, etc. It is also used for making permanent fastenings to sheet metal, etc. It is also used for making permanent fastenings to sheet metal, etc.



PARKER-KALON *Hardenad* Self-tapping Screws

SEE IN U. S. AND FOREIGN COUNTRIES



PARKER-KALON CORPORATION, Dept. A, 1000 Park Street, New York, N. Y.

Send me free booklets on the Economy and Security of assemblies made with Self-tapping Screws.

Name and Co.

Address

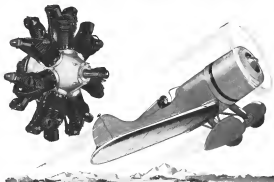


Continental

RED SEAL

ALWAYS THE MARK OF ENGINE QUALITY

NOW A GREAT NAME IN AVIATION



For 30 years the Continental Red Seal has identified engineering skill and dependability in gasoline engines. Continental—founded upon a sound administrative and financial structure—now makes the Red Seal the symbol of permanence and performance in aviation. Continental—its men—its facilities and its resources—guarantee to aviation a dependable and permanent source of supply.

CONTINENTAL AIRCRAFT ENGINE COMPANY

Licensed Office and Factory, Detroit, Michigan

Continental



ANNOUNCING SKY SERVICE

Rubber Covered TUBING

ABSOLUTE PROTECTION AGAINST FORCED LANDINGS AND FIRES FROM BROKEN FUEL OR OIL LINES

Developed by the Research Department of Sky Specialties Corporation, Sky Service rubberized tubing is made of either copper or aluminum tubing with all remaining rubber and fabric vulcanized to the metal tube and with special connections on each end.

This construction gives absolute insurance against freezing while in flight through leaks in fuel or oil lines.

For if through vibration, or other causes, a crack does occur in the metal tube, the rubber and fabric surrounding the tubing will continue to hold until such time as a repair can be made. Moreover the vulcanized rubber and fabric cover minimizes abrasion to such a degree that the life of the tubing will be practically that of the plane.

Tests conducted by the United States Army of Wright Field, Dayton, Ohio, prove that wireless ordinary tubing breaks down in 15 minutes under the severe test conditions they impose. Sky Service rubber covered tubing will stand the strain for a period of several weeks, which is equivalent to thousands of hours of flying.

Weight of the covered copper tubing is slightly greater than the commercial copper line, but the covered aluminum tubing is slightly lighter.

Plane manufacturers, by the use of Sky Service Rubber Covered Tubing can add considerable sales advantage by thus attracting the business for the operator and for the owner. Write for further information, giving size and length of the tube you are now using and the size of pipe flared connections at each end.

SKY SPECIALTIES CORPORATION
3434 HART AVENUE • DETROIT, MICHIGAN

LIGHTWEIGHT Radiophone equipment

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Type B Radio Telephone and Telegraph Transmitter. Weight complete—34 pounds. Priced at \$5,000.00 f.o.b., New York.



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Few flights have stirred the imaginations of their day like the epic "Dawn to Dusk" achievement of June 23, 1924, which made Lt. Russell L. Maughan of the United States Army the first man to dash across the North American continent under a single sun. Flying an army pursuit plane powered with a Curtiss D-12 engine, he took off from New York at daybreak, landing at Crissy Field, San Francisco, just as darkness was settling over the throat that had gathered to greet him. At his destination, as at every one of the five refueling stops, his motor was reported "cocking without a flaw." One reason for this was the fact that the all-important valves were Thompsons—"definitely chiseling," in the words of Curtiss' chief motor engineer, "any trouble from this source."

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WORLD'S Endurance RECORD ONCE MORE WON BY BELLANCA



84 hours 33 minutes

Walter Lees and Frederic Brown established a new endurance record (without refueling), 84 hours and 33 minutes, from May 24th to 28th, at Jacksonville, Florida, in a Bellanca Panharder powered with the Packard Diesel 225 h.p. Engine.

Internationally this is regarded as the most important airplane record—the only record that provides an attainable standard of load-carrying capacity. Beyond all challenge it proves the reliability of both plane and power plant.

The endurance load taken off by the Bellanca monoplane was 6,713 pounds gross weight. The actual useful load at the start was 4,500 pounds. This included the two pilots, supplies, and 551 gallons (about 17 barrels) of fuel and motor oil—equivalent to the weight of not less than 75 people.

ALL BELLANCA AIRCRAFT ARE BARELY-USED UNDER SUPERVISORY OF COMPETENT APPROPRIATELY CERTIFIED

Had the flight been made in a straight line at record cruising speed and fuel consumption, it would have covered a non-stop distance of 6,542 miles, or approximately the distance from Florida to Japan!

These stupendous facts proclaim the supremacy of Bellanca aircraft and the almost magical development of the Diesel type engine by Packard. It is significant that the Packard-Diesel engine gave its greatest demonstration



The Packard Diesel Aircraft Engine



Walter Lees and Frederic Brown, Packard Pilots, with their Packard-Bellanca

of economy and dependability in a Bellanca plane. For efficiency, safety and lifting capacity, combined with speed, the Bellanca holds its leadership year after year. Among the many reliability and efficiency records surpassed by Bellanca this is the third time the World's Endurance Record has been captured by planes built in only Bellanca's one build.

Many airplanes are being converted for the Packard Diesel-Bellanca combination for long-distance flying.

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New Castle, Delaware
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BELLANCA



Fig. 15 is a series of sub-illustrations of "How Roebbling Quality is Built into Roebbing Wire Aircraft Products"

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Photo No. 1. A detachment of Keystone Bombers was stopped at River Mountain, where the Italian River, while the planes were en route for their second visit to New York during the maneuvers.

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The recent air maneuvers brought home even to the most casual observer the remarkable efficiency of the Army Air Corps. Within a period of fifteen days, some 3,500,000 plane-miles were flown—a total of 31,500 hours in the air. Over 1,500 men were transported. This record is particularly remarkable when it is realized that the planes were operating from widely scattered bases and under all sorts of weather conditions.

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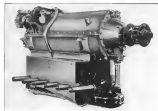
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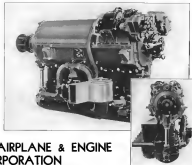
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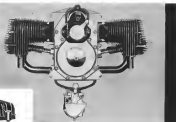
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New non-refueling WORLD'S DURATION RECORD

Walter Cox, pilot of light aircraft, making part of the last loop before taking off in the Packard-Diesel engine.



Established by PACKARD-DIESEL

After flying continuously for more than three days and nights, a Packard-Diesel powered Bellanca at Jacksonville, Fla., May 28th, set a new non-refueling world's duration record of 84 hours and 33 minutes.

On May 28th the ship took off with a gross load of 6,715 pounds, including 400 gallons of fuel oil. When the wheels again touched the ground at the back, the record established by the Frenchman Bessiere and Bess, in a specially constructed plane powered by a 600 H. P. gasoline engine, had been extended by 9 hours and 30 minutes.

This flight marked the successful culmination of Packard's efforts to recognize the significant world's non-refueling record for the United States. In April an attempt was frustrated by

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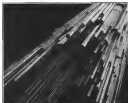
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CHAMPIONS Insure Better Performance Safety and Dependability



That Champion Aero Type spark plugs fill a long felt need is evidenced by the increasing demand from transport and mail lines, and private operators alike.

The reason is obvious. For in the Champion Aero Types are combined the benefits of best range in characteristics of Champion Silbansite—most penetrating—insulators, and the absolute dependability of a spark plug which cannot be broken in such a way as to interfere with engine operation.

Champion Aero Types have inherited all the performance characteristics of all Champions. The better performance of all Champions has earned for them the proud privilege of equipping and outfitting throughout the world year after year.

In addition, Champion Aero Type spark plugs incorporate a unique design specifically for aircraft engines. The result is a spark plug which brings to every aircraft engine a new factor of safety and dependability.

Install a set of Champion Aero spark plugs in your ship. Their better performance is more convincing than mere words.

- Champion Aero A Endorses Features**
1. Restricted heat.
 2. Special alloy steel insulator.
 3. Secondary alloy steel to damp vibrations.
 4. Nickel steel terminal.
 5. Copper alloy gasket.
 6. Primary alloy steel terminal.
 7. Nickel copper gasket seats.

**See Improved
Champion**
Spark Plugs at 7 Airlines
Tulsa, Okla. Wichita, Kan.

PARKS' AIR COLLEGE



PARKS AIR COLLEGE ADOPTS CABIN WACO "MODEL C"

Hereafter, Parks students will obtain flight instruction with selected cabin comfort by the WACO "Model C" which Oliver L. Parks describes as "the most perfect airplane I've found," so good that Parks students must have it "... for each one of us, in fact, unobstructed visibility, unprecedented speed for quick takeoffs and short landings have never before been associated with any cabin airplane... and especially one adapted to the features of flying itself." Isn't all this significant to you, too? Moreover, your use of an airplane will scarcely be restricted to short hops in close proximity to complete airport facilities. The more reason why your choice should be a WACO! For then, whenever you set down, WACO service is at your back and call. The service factor is an item that doesn't appear in WACO specifications. But don't overlook it in making your selection... whether you need be for 100 or 300 or 500... for an airport or a cabin WACO.

The complete WACO line ranges from \$4450 to \$19250 with highest standard equipment on all models.

Deferred payments can be arranged. And prices of a new WACO include any needed business for your distributor the month.

THE WACO AIRCRAFT COMPANY, 1937, 0910



WILLIAMS' DROP-FORGINGS
for Aircraft
Reliable Uniform Safe

The increasing demand for aircraft structural members has created a need for uniform and safe forgings of the highest quality. Williams' drop-forgings are the answer.

A full range of standard and special forgings, including: crankshafts, connecting rods, pistons, valves, and other engine parts. Also forgings for aircraft landing gear, fuselage, and other structural members.

Drop forgings are made from the best quality steel, and are forged in a drop hammer. This process produces a uniform grain structure, which is essential for the strength and reliability of the forgings.

Drop forgings are available in all sizes, and in all shapes. They are the most reliable and safe forgings for aircraft.

J. H. WILLIAMS & CO.
Buffalo, N. Y.
Chicago



If it's
DEPENDABILITY
you want...

...to keep your Production Lines on the move, Barnes-made Springs have been building a reputation for dependable service for years. Won't you tell us your spring requirements... one or a million?

The Wallace Barnes Co.
 BRISTOL, CONN., U. S. A.

AVIATION
July 2011

**Fortify for
Fire Fighting™**

Eliminate fire in oil
and highly flammable
liquids . . .
Prevent explosion . . .
Approved for
wood and textile
fires.



Pyrene Manufacturing Company

NEW YORK NEW JERSEY
LOS ANGELES CHICAGO ST. LOUIS
SAN FRANCISCO PHOENIX



Our wide experience in the field of **AUTOMOTIVE ENGINES** makes us a most practical source for

AIRPLANE SPRINGS

on a production or experimental basis

44 Van Fleet for Spring Service

BGR

RENTON DIVISION
1900 19th Avenue
1900 19th Avenue
1900 19th Avenue

BARNES-GIBSON-RAYMOND, INC.

EXPRESSIONS OF SATISFACTION FROM SEARCHLIGHT ADVERTISERS

I want to thank you for the meeting of 4 weeks of advertisements which has put in my Searchlight Notice. I have returned and hope for a very big sale.

"It is a advertisement from the 1st of October of 1934 which I was so glad to give the new and more of the place."

We are pleased to state that the Little Page which purchased, had been advertised in the Searchlight Notice in 1934.

"We, the Little Page, state that this was not due to your advertisement and the same was due to the fact that we were not in the Searchlight Notice in 1934."

Turn your used and surplus equipment into CASH. Meet a lot of the glass, engine and accessories you have for sale in the Searchlight Department and let us tell you exactly how much it will cost to advertise it. ADDRESS: SEARCHLIGHT DEPARTMENT—Fourth Avenue at 34th Street, New York City

<p>A Personal Want—</p> <p>can actually be filled by a friend.</p>	<p>The Searchlight Section</p> <p>of this issue covers the current business wants of the industries in which this paper is read.</p> <p>For Every Business Want</p> <p><i>"Think SEARCHLIGHT First"</i></p>	<p>A Business Want—</p> <p>must be satisfied by someone in your industry.</p>
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SERVICE and DISTRIBUTION for the Air Corps Maneuvers



In the carefully coordinated plan of the Air Corps, which made its recent air spectacle possible, one of the chief problems was that of arranging fuel and oil supplies. These had to be of highest quality. They had to be available, in varying quantities, from coast to coast, at each of the airports visited. Adequate facilities for rapid servicing of large numbers of planes were needed at each field.

The following approximate figures outline the service record of Stanavo distributors:

Supplied products to 52 fields (35% of fields visited)
Supplied three-quarters of a million gallons of

Stanavo Aviation Gasoline with Ethyl (87 octane number) (72% of the gasoline used)

Supplied 7,000 gallons of Stanavo Aviation Engine Oil (44% of the oil used)

Made available 650 men and 300 tank trucks for the actual servicing.

When you consider the purchase of oil and gasoline, consider also the proven record of Stanavo, not only in military planes, but also in the operation of leading commercial lines, the world over. You can rely anywhere and everywhere on the quality of the products developed by the organization which believes "the best is none too good for Aviation."



STANAVO AVIATION ENGINE OIL AND GASOLINE

One Brand—STANAVO—One Quality

—the Highest Throughout the World

STANAVO SPECIFICATION BOARD, Inc.

Organized and Recommended by

STANDARD OIL CO. OF CALIFORNIA
225 Bush Street, San Francisco

STANDARD OIL COMPANY (INDIANA)
146 N. Michigan Avenue, Chicago

STANDARD OIL CO. OF NEW JERSEY
15 Broadway, New York City

Navy Approves New Diving Bomber

VERTICAL DIVES from great heights—Immelmans—loops—inverted flying—with a 1000 lb. bomb load! This astounding performance of the New Martin Diving Bomber caused Navy Officials a year ago to acclaim a new era in aerial tactics.

Now, after a year's rigorous testing, comes an order from the Navy for two squadrons of these sturdy bombers, proving conclusively the success of this phenomenal plane.

Again, the Martin Company has demonstrated the dependability of its engineering methods—its unsurpassed capacity for producing quality aircraft in quantity at low cost.

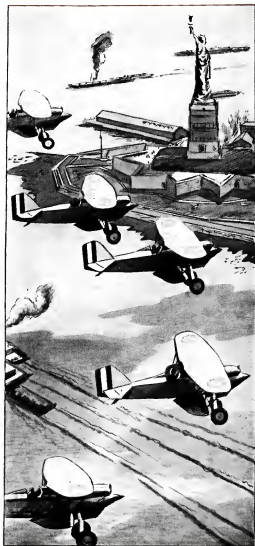
The Glenn L. Martin Co.

Builders of Dependable Aircraft Since 1908

BALTIMORE • MARYLAND U. S. A.



WITH THE ARMY'S THUNDERING HERD RIDE 258 WRIGHT ENGINES!



THE thundering herd of 672 Army planes has shown how dependable is airplane travel when piloted by able men and powered by capable motors.

They flew thousands upon thousands of miles in the Eastern manoeuvres and won a perfect score for safety and for efficiency!

Weather wasn't always favorable. Routes were tortuous at times. Take-offs and landings had to be made on all kinds of fields. A total of 3,200,000 miles were flown. Yet this great armada flew from State to State in tight formation and ended the manoeuvres without a single accident! The Army is proud of this. So is Wright. For in this big parade were 258 engines that they built.

But dramatic though this display of Wright's leadership is, it doesn't out-do the quiet demonstration that is constantly being made by Wright engines here and abroad. In fact 42% of all engines powering commercial planes in this country on January 1st of this year were made by Wright... a proportion far in advance of the nearest competitor.

Captain Hawks is showing Europe what the "Whirlwind 300" can do in smashing the major cross-country records over there. And Dornier made a significant move when he came to Wright for 12 Conqueror engines to power the 150-passenger DO-X.



WRIGHT

AERONAUTICAL CORPORATION
PATERSON, NEW JERSEY

A DIVISION OF CURTISS-WRIGHT CORPORATION

CABLE ADDRESS "AEROSOCO"

